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And last but not least, all those shooters who came to me with their problems and solutions. I have passed on as much of that information as I think will help other shooters.

CHAPTER 1

WELCOME TO THE SPORT

Welcome to the sport of Smallbore Target Rifle Shooting.

Welcome to a sport that can be enjoyed by everybody - *almost* everybody that is, because a serious criminal record would make life difficult for you (although minor infringements of the law certainly won't disbar you).

The only physical restraints are that you really need to be strong enough to hold a rifle up; however, that pretty well covers everybody over the age of twelve (and some youngsters below that age have managed).

There's no disadvantage in being tall, short, fat or slim, and both disabled and able-bodied people enjoy the sport equally as well.

The only qualification you really *do* need is a desire to do something different and exciting.

The top end of the sport is extremely competitive, but at other levels the majority of people shoot simply because they enjoy the challenge, the camaraderie and the socialising.

The sport is what you make it. If you're determined to compete in the Olympic Games, then here's a sport where you can. If you're content to take part without the need to compete, target rifle shooting will accommodate you as well.

There are no age restrictions: you can start as early as you like and finish as late as you like. Many people continue shooting in their eighties - there aren't many sports where you can compete with people a quarter of that age on an equal basis without being at a disadvantage.

There are clubs scattered all over the country - and indeed the world - so no matter where you live, there will almost certainly be a rifle club within a reasonable travelling distance.

A number of the more enlightened schools teach rifle shooting and there are many inter-school competitions.

The sport needn't be expensive; in fact, investing in secondhand equipment can get you started with a very modest outlay. Most clubs will loan out equipment free of charge, so the initial expenses are for club membership, range fees and consumables (i.e. targets and ammunition).

It is without a doubt the safest sport you could possibly consider taking up - a rifle range is the safest place in the world. There are fewer accidents in rifle shooting than any other sport (and that includes ballroom dancing and tiddlywinks!).

The challenge in the sport is in acquiring the skill to send a bullet down a range consistently and accurately, and that's the sort of skill used and admired in many other sports like bowling, archery, darts, curling, golf, boules, etc. etc.

The sport has been refined over the years and has now reached a degree of accuracy that would astound the rifle shooters of old, but the equipment used has also become more refined. Nowadays it's a very sophisticated, technical sport, but it still relies on the skill of the shooter.

You may never have heard of the sport, you may never have visited a range, but there will almost certainly be somebody amongst your acquaintances who has, or who knows somebody who has.

At one time every town in the country would have had at least one smallbore target rifle range, and all sorts of people would have used it. Sadly, a lot of ranges have now disappeared, but the sport is still alive and well.

The next time the Olympic Games are on the television, you'll see people from all over the world competing at Smallbore Target Rifle Shooting.

Why don't you join them!

CHAPTER 2

HISTORY AND BACKGROUND

Ever since man gained dominance over the other animals on this planet by constructing weapons with which to kill them, prowess with those weapons has been admired by his fellow men.

In the animal world it was always the biggest, strongest and fastest which survived. Man changed that balance by learning to hunt with weapons, and gradually he learnt that weapons gave him superiority over other men and well.

It's in man's nature to be dominant and this probably accounts for the superiority of the human race - we may not have been here today if it hadn't been for the development of weapons.

Man has always argued and fought, and he always will - that's why there's a war going on somewhere on this planet every day.

Wars have increased the sophistication of weapons and when there hasn't been a local war to be fought, men have met in *mock* battles and competitions. These have always been good spectator sports, because people can be involved in the excitement without the risk of their own personal failure.

When it was accidentally discovered in the Thirteenth Century that a certain mixture of chemicals went off bang when lit, this led to firearms starting to appear. Development was very slow at first and it took a long time - some 500 years - to persuade man to cast aside his trusty bow and arrow in favour of the new-fangled 'bang sticks'.

Once again it was war which was responsible for the rapid development of this new weapon. It was soon realized that, while it took many weeks of intensive training to make a useful archer, it took no time at all to get a soldier to point a tube and pull a trigger.

At first these new weapons were not particularly effective, but they did make a flash and a bang, and that frightened the horses at least! A good archer could get seven arrows in the air at the same time, whereas the poor old musketeer was much slower and not nearly so accurate at anything like the range of a good arrow.

Also, in the excitement of the battle, a musketeer was a walking bomb, because he had all his powder charges hung around his neck, as well as a lighted taper for ignition.

The ignition system *did* become more sophisticated as they moved from matchlocks to flintlocks but, even so, many muskets have been recovered from old battle fields, where the barrels were full of unfired musket balls. (The musketeer, in the excitement and noise of battle, didn't realize he'd only had a 'flash in the pan' without igniting the main charge.)

A major breakthrough came when a certain Reverend Forsythe managed to combine some chemicals based on a fulminate of mercury, which went 'bang' when struck by a hammer. That did away with all those lighted tapers and striking of flints to produce sparks.

That discovery revolutionised the development of the gun - suddenly they were much more reliable and faster, and no army could afford to be without them; today we're still using the same basic principle of hitting an explosive compound in order to ignite the main propellant.

However, two more major events occurred before we arrived at the modern rifles we use today.

The first was Mr Whitworth - a brilliant engineer who came up with a workable rifling system for the inside of barrels. This imparted a spin to the bullet which gave it gyroscopic stability. (During Government trials the Whitworth rifle was still putting bullets on the target at 2,000 yards, which was unheard of in those days.)

Suddenly soldiers no longer needed to be a very few paces away to ensure a hit, they could be hundreds of yards away and still do the same damage.

However, there was still one big disadvantage: shooting at your enemy from long range and behind cover was not particularly safe, because the pall of white smoke hanging over your muzzle gave *your* position away. So the race began to find a powder which did not smoke.

That led to the second major event.

A side development in the explosive field of nitro glycerine and dynamite eventually produced a cellulose-based powder which didn't smoke at all when ignited. It also burnt in a different way to the old black powder, and that made it a lot safer.

The old black gunpowder was extremely dangerous because it could be ignited with any little spark or flame, and it burnt with the same explosive force however it was contained.

Cellulose powder, on the other hand, is a progressive powder. That means that, when ignited in air, it's just inflammable without any explosive force. In a sealed container the first grain of powder which is ignited produces a gas which increases the pressure; this, in turn, ignites more powder and produces more gas, and so on until the container bursts. All this takes place in thousandths of a second.

Suddenly the soldier had everything he wanted: accuracy, safety and reliability, and the gun became the main weapon of an army.

Target shooting has always run a parallel course to the need for military firepower - it's no good giving a soldier an accurate gun if he can't hit anything with it. Every army in the world has to teach its members how to shoot - they have to shoot at something, and paper targets are cheap.

In the days when the British Army was all-powerful they went to Africa to settle an argument and ended up fighting the Boer War. In those days the British Army officers wore red uniforms and marched into battle in straight lines. The Boers on the other hand were Dutch farmers who used their rifles for hunting for food on the plains of Africa. They wore their normal working clothes which blended in with their surroundings, and they were excellent shots at long range.

It was an uneven contest. Laying prone on the top of a hill behind a rock and shooting at some soldiers standing in straight lines and conveniently dressed in bright red was easy for the Boers, and they made mincemeat of some of the British battalions.

Many brave and gallant soldiers died on both sides during that war, but superior numbers told, and eventually, despite their losses, the British forced the Boers to surrender.

However, back in Britain, questions were asked about the British Army suffering such losses and about how we would defend ourselves should we be invaded.

A certain Major-General Luard came up with the answer: he proposed that facilities should be provided for the instruction in the 'Science and Art of Rifle Shooting'. He further proposed that this should be aimed at the ordinary working man in the street.

The .22 rimfire rifle and ammunition was chosen because it was cheap, and could be shot indoors in heated buildings during the long cold winter evenings.

In 1901 a society was formed called *The Society of Miniature Rifle Clubs* (this was changed to the *National Smallbore Rifle Association* in 1947). The General enlisted the help of Earl Roberts who had just returned from sorting out the Boers in Africa and was an influential national hero.

The British long-range .22 rifle championships are still called *The Earl Roberts* today.

Clubs sprung up all over the country and proved to be very popular. Competitions were organized where clubs shot against each other; there were inter-services matches, civilians versus services, county matches, national matches and eventually (when the rest of the world caught up) international matches.

As the whole scheme was devised to contribute to the defence of the Realm, it was deemed to be a charitable enterprise; rifle clubs were consequently allowed to become registered as charities, which resulted in some savings in running costs with rates and taxes.

Proof of the effectiveness of the general's idea was shown in the First World War when the civilian rifle clubs provided instructors to help train the infantry in shooting. The Germans were amazed at the accuracy and speed of the British rifle fire.

Nowadays rifle shooting has developed into a very technical sport and its relationship to the needs of the army has grown more distant. However, the competition is just as fierce and now there's the rest of the world to take on.

The *Commonwealth Games*, *Olympic Games* and *World Championships* are the top of the tree for the aspiring marksman and this country has produced gold medal winners in all of those competitions.

Sadly, the news media has found that misuse of guns sells newspapers because of the shock-horror syndrome. That, unfortunately, has curtailed the expansion of the sport in this country, and the rest of the world has now overtaken us.

If there is any justice in this world, the sport will grow again when people realize the advantages to be gained: things like discipline, concentration, team spirit and the general benefit of taking part in something.

Every sport has its winners and losers; of course, losing is sad, but winning is great and you'll never win if you don't take part!

CHAPTER 3 GETTING STARTED

FIRST FIND YOUR CLUB

The first thing you need to do in order to enter the sport of smallbore target rifle shooting is to find a club, and this can be the first major hurdle, as clubs don't generally advertise their presence, and they don't go out of their way to recruit new members. Don't let this deter you; once found, the club is your route to the top.

Nearly all the clubs in the UK are run by the members themselves and, because firearms are involved, they are extremely reluctant to broadcast private addresses to all and sundry.

Libraries usually keep lists of local clubs of all types; local newspapers may publish results and be able to give you a contact, or the Police could help, but the people who should know where every club in the country is situated are: *the National Smallbore Rifle Association, Lord Roberts Centre, Bisley Camp, Brookwood, Woking, Surrey GU24 ONP Tel: 01483 476969.*

A short, polite note to the NSRA asking for details of clubs in your area will probably get you a choice within a reasonable travelling distance. For security reasons you may only get a name and a telephone number, but that's your starting point, and the rest is down to you.

When you make your phone call, bear in mind that you're talking to an unpaid official who may have only just got home from a hard day's work; explain that you're interested in taking up smallbore target rifle shooting and ask what the club's system is for dealing with newcomers.

You will receive a warm reception; newcomers are always welcomed as they are the lifeblood of the sport.

Generally there are no age restrictions (depending on the individual club's insurance policy), but there could be some size and strength restrictions because target rifles are extremely heavy. Very young people under the age of 12 for example, could experience some difficulty in coping with the physical side of the sport (this may also apply to slightly-built ladies).

However, don't be put off; arrangements can be made to accommodate most people whatever their age or size, so do at least have a go. Most clubs have facilities to help youngsters support the weight of a rifle when they first start, so discuss this when you visit the range.

YOUR FIRST CLUB VISIT

Having made arrangements to attend the club at a certain time, dress casually and be sure to arrive promptly; there's nothing worse than a club official having to give up his shooting time to wait around for a tardy newcomer to turn up. The person who greets you may be the one you spoke to on the phone, or the club may have an officer appointed to welcome and initiate newcomers into its particular routines.

Don't be shy and don't be afraid to ask questions; there's nothing a shooter likes better than explaining the intricacies of his sport to an interested novice.

Clubs work in different ways, so it would be impossible to detail exactly what to expect, but here's a general idea of what might happen.

Your first contact with the club will probably be the Secretary - a hardworking individual who gives up a lot of his/her spare time, usually without reward and often without thanks, for the benefit of the club. You will be shown round the premises and be given a brief outline of how things work; don't worry if the procedures sound complicated, you won't be expected to absorb it all on your first visit.

If you wish to continue to the next stage of enrolment, you'll be asked to fill in an application form (some clubs may ask you to do this as soon as you step through the door - don't be alarmed at this, it's one way of registering your presence on the premises and may be an insurance requirement.)

Most clubs have indoor ranges, and this is where you should expect to start. These are usually 25 yards long, although 15-yard and 20-yard ranges do exist (they use correspondingly smaller targets but as target sights all work the same way, the visible area of the target always appears to be the same size whatever the range you're shooting at).

Although 15 yards or 25 yards may not seem very far, rest assured that the bull (the centre of the target which scores as a 10) is very small.

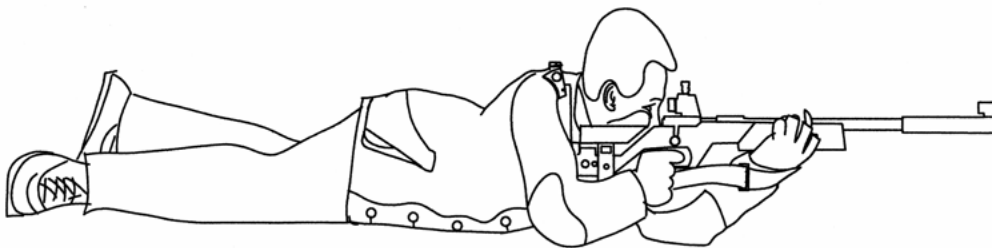
THE GROUP

When you first have a go you will probably be given targets without scoring rings. This is not because you're looked upon as a second-class citizen, or because you're in some way incapable, it's more that the club wants to start you off in the right way and impress on you that it is the size of your group which is most important.

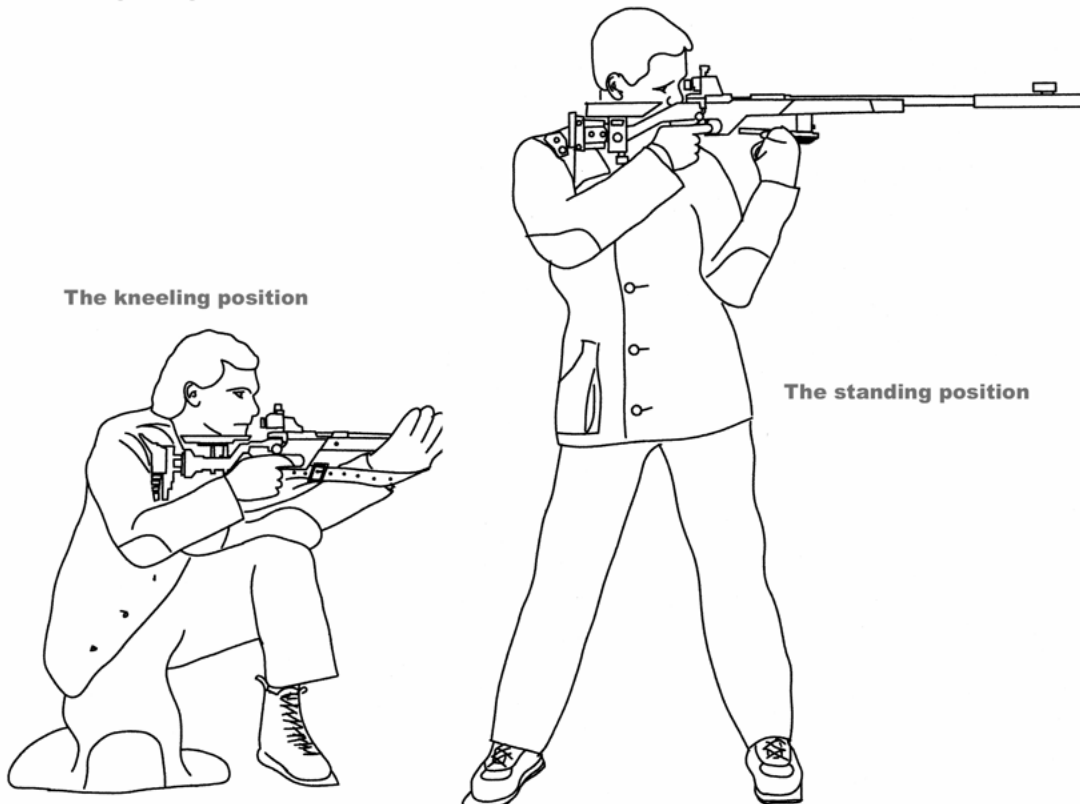
'Group' is one of those words you'll hear bandied about the clubroom. All it means is a group of shots, and that can be any number between two and hundreds, although people generally talk about things as a 'five-shot group'.

Target shooting is all about consistency; anybody can get a brilliant score once, but what you have to do is be brilliant all the time; therefore the measure of your brilliance is the smallness of your group.

POSITIONS



The prone position



The kneeling position

The standing position

Smallbore target rifle shooting is shot from three positions - prone, kneeling and standing. As a beginner you'll be expected to start with the prone position which is generally thought to be the easiest

There is nothing mysterious about 'prone', it just means lying down; what *is* mysterious is why you do it lying on your stomach when most people would find it more comfortable to lie on their back, particularly when a hard concrete floor is involved!

However, lying on your back makes it very difficult to see anything other than the ceiling or sky, so lying on your stomach does at least allow you to see the target in front of you (with a bit of neck-stretching).

By lying on your stomach and raising yourself on your elbows you could quite happily watch television or read a book, so using a rifle is not as much of a strain as you first thought.

Prone is the most stable of positions and the most suitable for the beginner. After you've reached a certain level of proficiency, the delights of the other two positions can be tackled, but in the meantime, just get on with the prone position.

EQUIPMENT

In your early visits to the club you'll be introduced to a bewildering assortment of pieces of equipment (explained in detail in later chapters), but just for the moment we can label them quite easily.

The rifle is a heavy cumbersome thing, made of wood and metal, some 4 feet in length and weighing about 12lbs or more. Treat it with respect, it's a precision instrument and very expensive.

You may be given what appears to be some 50-year-old piece of ironmongery but that's no excuse to treat it any less carefully than you would if it was your own and you'd just paid £2,000 for it. It may be old (even older than you) but it's still capable of shooting better than you, so you should treat it with respect.

The first rifle you shoot at the club will be either a Martini action or bolt action (there aren't many other types of action around, and none of the others is used in target shooting).



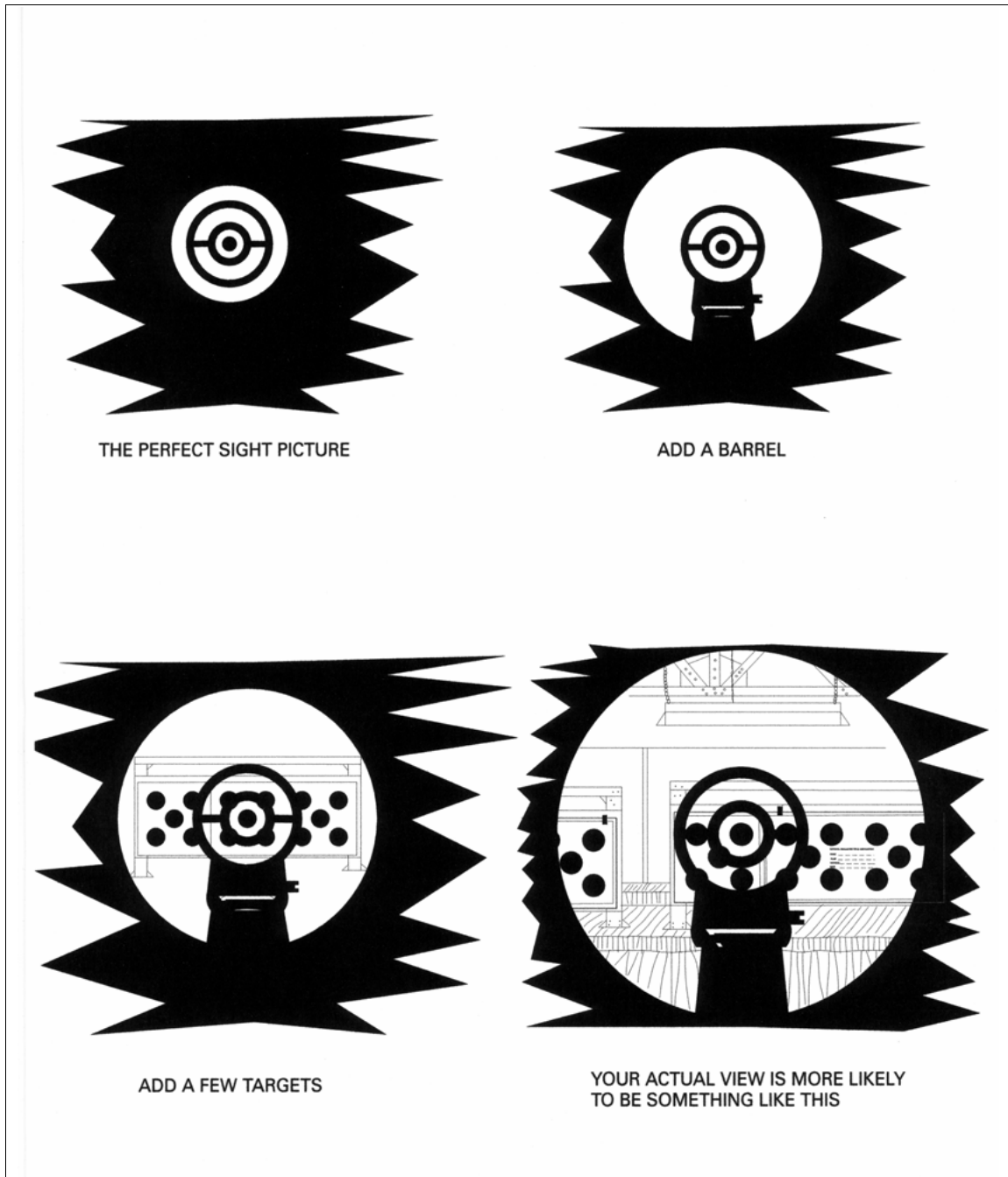
Your club coach will teach you which end is which, where to put the ammunition in, and where it comes out, so we won't try to fill your head with such basics here. Just remember that what seems strange to you now will become second nature in a very short period of time.



A typical rearsight

On top of the rifle will be a set of sights; the one nearest the wooden stock (the rearsight) will be an aperture or small pinhole sight; the one at the front (the foresight) will take the form of a ring inside a tunnel just above the muzzle.

It would be very easy at this point to say that you look through the rear one and line the front one up with the target - and that really is all you do - but as you've probably already guessed, things are never that simple.



The perfect and not-so-perfect sight picture

The illustration shows the perfect sight picture, to illustrate how the aiming mark (the large black mark which surrounds the bull) should look inside the foresight ring, which is in turn surrounded by the foresight tunnel, and then the aperture. As you can see, it's just a question of concentric circles, and ensuring that each circle is in the centre of the next one. It sounds easy, doesn't it?

When you're given your first club rifle and shown how to lie on the floor, the illustration is what you should see when you look through the sights. Depending on the distance of your eye from the rearsight, the amount of scenery you see surrounding the foresight tunnel will vary; that's not important and is down to personal preference, as long as the rings are concentric.

At the same time as you're given your rifle you'll be given one or two other items of equipment:

THE SLING

First there is a sling; nowadays this is a one-piece affair designed to be attached to the upper arm; it's used purely to help support the weight of the rifle, without you having to use muscle power to hold the rifle in position.

Calling it 'one-piece' may be slightly confusing, because there are still a few slings about which consist of a cuff which wraps around the upper arm, and a leather strap which hangs on the rifle and then hooks onto the cuff when you're in the prone position.

Thankfully this type of sling is gradually being phased out and more modern slings, as will be described later, are now in vogue, as these are much more reliable and easier to use. At the club you'll undoubtedly see people with these modern one-piece slings dangling from their arms.

One thing you'll notice before you get very far is that lying on a hard floor can be a bit painful on your elbows after a while, and you'll probably also have seen that most other shooters are wearing some sort of protective clothing with padding on the elbows.

Generally the club will be able to provide you with something to help alleviate the pain - either a jacket, or at the very least some detachable elbow pads which strap around the elbows to protect them from the hard floor.

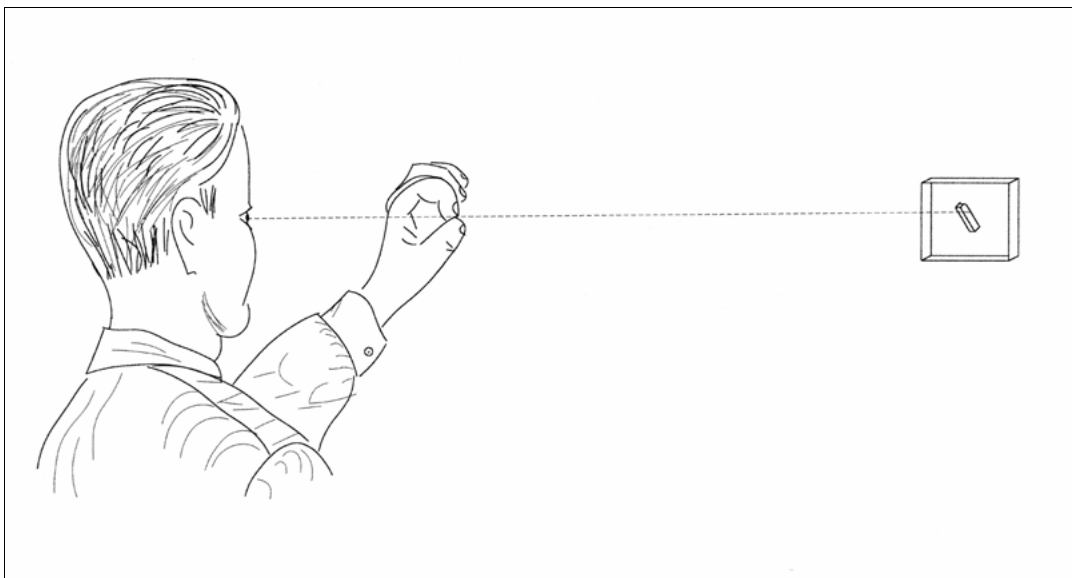
Even if your club can provide you with something, you'll still find that wearing a shirt, with a cotton sweatshirt plus an ordinary cloth or denim jacket, will be the most practical thing to start off with.

YOUR MASTER EYE

One of the first things you're going to be asked before they start trying to dress you up in all this wonderful gear is whether you're right-handed or left-handed. What they really want to know is whether you're right- or left-eyed, because it doesn't really matter which way round you hold a rifle (although one way will probably feel more natural than the other), what is of paramount importance is which is your master, or dominant, eye.

It's important to get it right, so it would be useful for you to know the answer before you get down to the club. Here's a simple test which should help you decide: with both eyes open, look across the room at an object - for example a light switch - about 3 metres away.

Make a circle with the thumb and forefinger of your right hand, then circle the object with it and immediately close one eye. If the object remains within the circle, you've just closed your non-master eye. If the object leaps off outside the circle then you've just closed your master eye.



Choosing the master eye

You may get some strange looks if you start doing this on a crowded train or bus, but if you try it down the club nobody will think you're at all strange. In fact, this is something which shooters should be doing all the time, because eye dominance can change over the years.

If you happen to be left-eye dominant but do everything right-handed (or vice versa) don't despair; things won't be ideal, but corrective lenses are allowed, and providing the sight in your eye isn't seriously defective, your friendly local optician should be able to help.

If, however, your master eye is dominant because your other eye is especially weak, you should seriously consider using the best eye for your shooting; if that happens to mean you shoot left-handed, you're not at any particular disadvantage, other than left-handed equipment tends to be slightly scarcer

and consequently more expensive.

Most clubs have left-handed rifles and equipment as well as right-handed, and every rifle club has a proportion of left-handed shooters. There are some people whose eyes are very evenly matched and if you're one of these people (and that may mean that you're good at ball games, for example) then you may find that your other eye is trying to take over when you shoot.

This is a problem many people have and, closing one eye (which is the natural thing to do) is detrimental to the sight in the other eye. You will, therefore, see all sorts of devices for obscuring the sight in your non-aiming eye.

Once you've established which is your master eye, that will tend to dictate which way round you shoot, but do explain to the club official if anything causes you difficulty; after all, he wants to help.

You may be offered a glove to wear (only one!) and this will make your life much more comfortable. If you're right-handed you'll be offered a glove for the left hand, because that's the hand which supports the rifle.

NOISE

One factor which all shooters should be aware of is noise. The types of rifle and ammunition used in smallbore target rifle shooting are just about the quietest of all the firearms, but even so they can still make quite a hefty crack indoors.

It's not the volume of noise which causes the problem, it's the consistency involved. Because sound is always at its most penetrating at one particular frequency, it's quite possible for people to have their hearing affected at that frequency.

That won't be particularly noticeable at a young age, but once your hearing is damaged in that way, it will never get any better.

All this is leading up to the fact that you *must* wear some form of hearing protection and this should be offered to you by the club (in fact they may even have a rule that nobody shoots without hearing protection). However, if you're not offered any earmuffs before you go into the range (even if you're only going to watch), then do ask; nobody will criticise your request. (There is another advantage to wearing earmuffs: they help enormously with concentration, so all the top shooters wear either earmuffs or earplugs.)



Ear muffs and plugs

If you wear glasses to correct an eye defect, don't worry - perfect eyesight isn't absolutely necessary in order to make a good shooter, and even people with 'perfect' eyesight often have a special lens purely for shooting, to help them get the correct sight picture.

SAFETY

At this point something should be said about safety.

Shooting is the safest sport you can take up, but that's because the participants keep it safe for each other. When you enter your first rifle club you immediately come under the protective eye of every person in that room, because they all want you to have an enjoyable - and safe - time.

Your job is to learn what keeps it such a safe sport and how you can protect the people around you. So, let's start with the basics; it takes three things to make a gun accident: a gun, some ammunition and an animal (human or otherwise). Therefore, the basic simple rule is that you can have a combination of any two, but as soon as you have all three there's the potential for an accident.

Obviously you can't shoot if you don't bring all three together at some time.

However, if you're holding a loaded rifle you're intending that it should go off at some time or other; what everyone wants to do is ensure that it only goes off when it's pointing at a target.

Not only should you be safe, but you should be *seen* to be safe. For example, your ammunition should *always* be kept separate from the rifle except when it's on a firing point.

Every rifle has an action (i.e. the part of the mechanism used for igniting the cartridge, and also the part which is opened to allow the insertion of a round of ammunition). If the action of a rifle is open, it cannot be fired, so a bolt-action rifle with the bolt open and back, or a Martini-action with the lever forward and the block down, is safe, and can be seen to be so.



An open bolt action



An open Martini action

If every rifle that you pick up, or have handed to you, has the action open, you

can see instantly that it is safe. Likewise, if every rifle you put down or hand to someone is the same, then they can see that it's safe.

If anybody hands you a 'closed' rifle, the first thing you must do is open it and check it's empty. This should never happen, of course, but the safeguards are there for the protection of us all.

Don't be offended if someone comes along and opens the action of your rifle if you have forgotten to do it yourself (the reason why shooting is such a safe sport is that we all look after one another's interests). By the same token, nobody but a fool would be offended if you were to open a rifle action which has been left unattended and closed - just do it without fuss.

The other fundamental rule is that you never ever, under any circumstances, point a rifle at anybody else, even if you know it's safe. That may sound terribly obvious, but in a busy clubroom in the rush to get your rifle onto the firing point, you may commit the cardinal sin of carrying your rifle horizontally. You may know that the action is open and it's unloaded, but does the person next to you, or (more importantly) in front of you?

Unfortunately you'll see many rifles carried horizontally, but it's a potentially dangerous practice and, therefore, as a beginner you should try to get off on the right foot and not do it. Rifles should be carried vertically, either muzzle up or muzzle down.

There really is no excuse for carrying a rifle horizontally (and this is a dig at some of the more experienced shots); apart from the safety considerations, it takes up a lot more room that way and is much more likely to bang into something and be damaged.

It's not recommended that you, as a beginner, go around admonishing everyone you see carrying his rifle parallel to the ground, but now is a good time to set your own good standards for the sake of your rifle and the peace of mind of your fellow shooters.

Every club has a range and every range should have a Range Officer who is responsible for safety. With safety in mind, every club has its own set of rules, but they're all based around a common formula of 'safety first'.

As a beginner you will be introduced to that formula gradually, but just remember that the sport *is* so safe because everyone obeys the rules.

THE SHOOTING

Now let's get down to the exciting bit. Your new club probably has a club instructor, or coach, or at least a helpful club member who is prepared to give up his time to get you kitted out with the right equipment.

The first part of this book will give you some basic pointers about how to get started which, when added to practical on-range experience, will set you off on the right track.

After your first couple of visits to the club you should start to recognise one or two faces, but what you may not recognise are the amazing bits of equipment everyone is using, so here's a brief glossary of terms that will at least help you to understand what people are talking about.

Rifle: This is fairly obvious, but please don't refer to it as a 'gun'; most people simply use the manufacturer's name, such as Anschutz, BSA, Feinwerkbau ('FWB'), Walther, etc.

Jacket: This is like no other jacket you've ever seen; it has elbow pads, shoulder pads, maybe even the odd pocket; it's usually made of canvas but lots of top shooters (and not-so-top shooters) have leather ones, which look and feel nicer, but cost twice as much.

Sling: This used to be made of thick cowhide leather with various buckles, clamps, hooks and holes, all designed to be adjustable for people of all shapes and sizes. Nowadays they're made of a synthetic material such as plastic (or a combination of plastic and canvas), so that they don't stretch. Their function is to help hold the weight of the rifle in the prone and kneeling positions.

Glove: You all know what gloves are, but at a rifle club you'll only be given one and that may not have fingers in it; its principal purpose is to make life more comfortable for the hand supporting the rifle.

Earmuffs: These are an essential part of your safety equipment; .22s may not be particularly loud but the constant crack at the same pitch can cause a bit of damage to your hearing.

Mat: You - like 90% of rifle shooters - will be expected to lie down on the floor and shoot. Sometimes the floor doesn't get swept as often as it might do and it's usually quite hard, cold and uncomfortable to lie on - hence the need for a nice padded mat.

Hat: Most of you probably know what a hat looks like, but the hats rifle shooters use have very long peaks with flaps on both sides to aid concentration and keep out stray light.

Ammo Block: This is not essential but it can help you keep track of the number of shots you've fired. Most modern ammunition is usually packed in easy-to-use plastic boxes or trays, so blocks aren't used much these days, but some clubs insist that beginners use them for safety reasons.

Spotting 'Scope: This enables you to see where each shot has gone; on your

first few visits to the range someone else may do the spotting for you.

That concludes the basic list of equipment that you're likely to have thrust into your hands, and to further help you understand what's going on, here's a few more expressions you might hear.

Targets are usually called 'cards'; a perfect score of 100 may be referred to as 'a ton' or 'clean'; as most people still refer to their score in terms of the number of points dropped out of 100 (97 would be '3 off'), the phrase 'going clean' means not dropping any points.

Most scores are recorded as points dropped because it takes less room (and time) to write '3' instead of '97', so everyone has become used to referring to the mistakes they've made. This could, of course, be deemed to be negative thinking and there are moves afoot in some circles to make shooters adopt a more positive attitude by thinking in terms of points scored.

Whichever system your club uses, you'll soon get used to it, and it's just as much of a driving ambition to 'go clean' as it is to score 'a ton'.

LEAGUES

Competitions are shot in 'rounds' - usually one card - but it can be more than that. Most competitions, which are referred to as leagues (just like in football), are shot on a 'postal' basis, which means that the cards are shot on your own range and then sent away by post to an independent scorer.

There are lots of different leagues to enter; some are organised by our national governing body - the National Smallbore Rifle Association - and others are run by regions, counties or more local groups.

Don't be unduly alarmed if one evening, after you've only been a member for a short time, you suddenly have a card thrust into your hands with somebody else's name on it (scrubbed out) and you're asked to be a substitute.

The poor Club Captain, who has the thankless task of getting everybody to shoot their cards on time, occasionally gets let down by a team member; just remember that whatever score you manage to achieve, it will be better than the team losing 100 points because the card wasn't shot at all.

Other words to learn are foresight and backsight (or rearsight); these are fairly self-explanatory - the backsight is the big black adjustable thing over the action of the rifle, and the foresight is the small tunnel above the muzzle of the barrel.

The long piece of wood under the barrel is the forend and the bit of wood at

the back is the stock; the butt is the very back end where - hopefully - there will be some form of adjustable plate to fit into your shoulder.

Hanging underneath all this somewhere in the middle should be a trigger, protected by a trigger guard.

Ammunition is 'ammo' or 'rounds' (not 'bullets' - these are the grey lumps of lead which come out of the muzzle and make the holes in the target).

At this point it's worth mentioning that the club will have strict rules about what you can and can't do with ammunition.

Initially you won't be allowed off the premises with any ammunition. That is only allowed once you've served a probationary period with the club and then obtained a licence from the police. That is the law.

Each club will have its own rules about how you are allowed to handle the ammunition on the range, but everything will be done to make it safe, legal, and convenient for you.

If somebody shouts at you to pickup your 'empties', they're referring to the empty brass cases you eject after firing your rifle. Don't leave the last case in the rifle when you've finished - eject that as well and leave the action open.

Misfires occasionally occur, so if you get one (when you hear a 'click' instead of a 'bang') don't do anything - at least not for 30 seconds. This is because, instead of a misfire it may be a 'hang fire', which is where the round goes off a few seconds later; if it hasn't gone off in 30 seconds it's unlikely that it will, and you can safely eject it from the rifle, but please remember to pick it up and ask somebody to dispose of it safely, as it could still be dangerous.

It's important to keep the rifle pointed down range at all times if you suspect a misfire/hang fire.

As a new visitor to the club - or even as an established visitor changing disciplines - there will be plenty of people to help you get down into the prone position, adjust your sling, etc. The main purpose of these chapters is to go beyond that and give you some pointers as to what you should be going through when you prepare to fire.

There's one very important fact to remember about all forms of target shooting and that is: you can't influence where that bullet goes after the primer has been ignited.

Once the trigger has been released it takes approximately three thousandths of a second for that bullet to accelerate to 700 mph and clear the barrel - that's

several hundred times faster than you can blink!

Therefore, everything has to be right *before* you release the shot, and you have plenty of time to get it right. It's all very easy to realise that you've done something wrong when the rifle reacts differently as it goes off; it's too late then - you should have got it right before.

It would be very easy to say that that's all there is to it, but that would be oversimplifying the situation and of course, the whole question is "how do you know when it's right?"

There's no simple answer to that, and you could argue that the basic rule of rifle shooting is consistency, so, in theory, as long as you make the *same* errors every time, you could shoot well because you would have a small group.

If you could eliminate all the errors which create bad shots, you would undoubtedly shoot better, but it's almost impossible to re-create the same error each time in order to be consistent. It makes a lot more sense to try to re-create the perfect technique.

BREATHING

One very big, obvious, possible error which you can see as a beginner, is your breathing. It's fairly evident to anybody who has ever held a rifle that your body expands and contracts as you breathe, and that movement is transferred to the rifle. As a beginner you might think that this is an easy problem to cure ("I'll just stop breathing"), but rifle shooting is never that easy.

It's true that you're never going to consistently hit a target while your rifle is bouncing up and down as you inhale and exhale, but when do you actually stop breathing? If you stop too early you're going to cut off the supply of oxygen to your brain before you can get your shot away and that will affect your sight picture. If you leave it too late you could be snatching a quick breath and then yanking on the trigger.

What you have to do is breathe normally; don't attempt to adjust the rhythm of your breathing, because that will upset other rhythms in your body, which will then try to compensate, and everything will get out of balance.

While you're breathing you can settle down and get everything else right; it doesn't matter if the sights are moving up and down on the target during this preparation work. When you think you're ready, exhale and don't inhale. If you're set up properly, the last exhale and hold should get the sights aligned on the aiming mark without you holding the rifle on the target.

You will have a comfortable, relaxed 10 seconds or so in which to release the trigger without rushing, and that's plenty of time to confirm whether the sight picture is right or not. If, at about 10 seconds, the shot hasn't been released, you should relax, take your finger off the trigger, breathe again and start the whole procedure once more. (Whilst you may not appreciate the passing of the seconds exactly, if you think you've been hanging on for too long, then just start again).

It's important that the final relaxation as you exhale should bring the sights to rest comfortably on the target, and that's where correct setting up is important. This is what you are aiming to do; it may feel uncomfortable to start with, but not unpleasantly so. You are, after all, using muscles in a different position to normal, so give them time to adjust.

If somebody is on the firing point helping you, tell them how you feel if you relax; does the rifle sag down off the target? If so, try pulling up your sling by a notch.

Keep adjusting yourself and your equipment until everything is right; while you're learning, this period of getting into the right position is very important - your body has got to learn what is expected of it, and you must know what it feels like.

POSITION

The prone position is dealt with in some detail in chapter 10, so just for now remember that if someone is helping you on the firing point tell them if anything they are asking you to do is painful.



The prone position

You will have to accept a small amount of discomfort to start with because you're asking your body to do something it's probably never done before and the muscles will need a little stretching. Nothing should be so uncomfortable as to actually cause you any pain.

The whole idea of a good natural prone position is that it is relaxed, comfortable and balanced. There should be no effort required to hold the rifle on the target, it should aim at the target naturally while you remain relaxed.

Small movements of your body relate to large movements of the shot on the target so learn to lay still and only move the parts of your body necessary to reload and look through the spotting scope.

If anything collapses when you relax after getting into position then it means that you're not balanced. If you fall over when you try to reload it's because you're not balanced. Balance is very important and necessary to stop you moving too much.

Persevere, although it may seem very strange to you at first this is the way all target rifle shooters start and it gets easier the more you do.

CHAPTER 4 APPLYING FOR A FIREARM CERTIFICATE

THE FIREARM CERTIFICATE

Those of you who have now served a six months' probationary period at your club will be getting excited at the thought of at last being able to go out and acquire your own rifle.

Before you do that however you need a Firearm Certificate (FAC) which will license you to hold and use a .22 rifle

Before you apply for your first FAC it's well worth having a word with your club committee, rather than plunging into the murky waters of firearms legislation without a lifebelt.

It is the responsibility of at least one member of every club committee to keep up to date with the intricacies of the Firearms Acts, as far as they apply to their members, so they can inform and assist with FAC grants, renewals and variations.

GET SOME HELP

You may think that, once having been granted a Firearm Certificate there should be no problems, but your certificate does have to be renewed and as the appointment of local Firearms Officers can change overnight, you could find yourself dealing with someone new, who can't, for example, see any need for you to have more than 100 rounds of ammunition at a time.

This is where the club committee has a duty to protect its members, by at least knowing what is allowed and what is not, so as to avoid any problems in processing your application.

Even though you may feel secure because you have your FAC, and you're not doing anybody any harm, just remember that the fringes of our sport are constantly under attack, as guns are a very emotive subject, so it's important to get things right, and not be misled.

Now for your first application.

THE APPLICATION FORM

First, you need an application form - the same form covers a grant, renewal or variation. They are normally available from your local police station, but if you have any difficulty, ring your County Police Headquarters (number in the phone book) and ask for the Firearms Department; they should then be able to put a form in the post

to you.

The Firearms application form is blue - if you end up with a yellow one, take it back as that only covers shotguns.

Don't be put off by the amount of paperwork that arrives with the form. You are required to get referees who are prepared to say what a good character you are, and that means extra paperwork.

The application form consists of three A4-sized sheets of questions plus a back page of guidance notes. However, when you come to fill it in, do get some help from a fellow club member, or at least from this article.

The first part of the form is all questions about yourself, i.e. full name, previous names (e.g. woman's maiden name, change of name by deed poll, etc.), then your address.

Question 12 is about where you work and your phone number there.

This question could be a little disconcerting, because you may not actually wish the people where you work to know that you shoot - not out of embarrassment, but purely from a security point of view.

If you think this question could be a problem (and don't forget that security is your responsibility!) ring your Police Headquarters, ask to speak to the Firearms Officer (i.e. not one of his clerks) and explain your reservations. He should be sympathetic and allay your fears; remember to take his name and keep a note of your conversation.

Question 13 is about any previous addresses you may have had in the last five years.

THE PRESCRIBED FORM

It's probably worth pointing out here that Form 101 is what is known as a 'Prescribed Form'. This means that you are obliged to answer *all* the questions, and failure to do so will undoubtedly lead to a delay in processing your application.

Question 14 really does cause a bit of head-scratching because it asks whether you have any convictions. Here you must be very careful - it doesn't ask for 'recent' convictions or convictions 'of a serious nature' - it just asks for 'convictions'. So if you were prosecuted for dropping litter in a public place because you threw a sweet wrapper away in 1965, you should declare this.

It is a peculiarity of the Firearms Application Form that every conviction must be admitted (even minor motoring offences), but don't be afraid that this will jeopardize your chances; you have to have been sentenced to at least three years' imprisonment

before you are automatically refused by the Chief Constable, or you have to have a long history of robbing banks, riot, affray, public disorder, etc. which might make him think you're going to be a danger to the public.

If you have been guilty of the odd misdemeanour (speeding, parking offences, etc.) then put these down on your form; if you can't remember the exact dates and places then state something like 'various motoring offences between such-and-such years'. Some more serious offences, such as drink-driving, may have some bearing on your application but, again, this depends on the circumstances and how long ago it was, so if you have any doubts, your Firearms Officer is the person to speak to.

The next question (No.15) makes enquiries about your health and mental health (similar to those on a driving licence application form); answer honestly - only rarely do these sort of problems cause your application to be refused.

The name and address of your current GP is required next, and you have to sign the form at this point to say that you give permission for the police to obtain details of your medical history.

THE SECOND PAGE

Part 'B' of the form on the second page starts with a question about the firearms in your possession at the time of the application. Obviously if this is your first application then you write 'none'. Even if, for example, your club is holding a rifle on its certificate for you, you must still write 'none', because you can't actually *own* a rifle until you have your own certificate. That is question 17; question 18 goes on to ask what ammunition you have in your possession which, as a new applicant, you write "none" here as well

If you're renewing your certificate, or asking for a variation, then put down everything which you have in your possession. Anything that you've sold, lent or hired to somebody else doesn't count if they've been transferred onto their certificate (which they should have been).

Question 19 is your opportunity to list all the firearms you would like to possess. There is no limit, in law, to the number of firearms you may have, but your local Chief Constable has the power to insist that you show 'good reason' for possessing each individual firearm, and it would be difficult to give enough reasons for more than two or three .22 target rifles.

It is recommended that you ask for permission to acquire at least two target rifles. Your certificate will last for five years, and a lot can happen in that time; whilst you can apply for a 'variation' to your certificate at any time, an actual increase in the number of weapons could cost you a renewal fee each time.

Therefore, although you may only just be starting in the sport, consider the following:

You could be entering a number of big competitions, when you may find it advisable to have a spare rifle, or if you take up 3-positional rifle reasonably seriously, you may wish to keep one rifle set up purely for prone-only competitions, and have another for 3-P. You may also fancy doing some 'scope shooting, either in 'any sights' competitions or as a training aid, so you *could* keep a rifle specifically for this.

You should also note that the Law says that you can't purchase or acquire a firearm without authority to do so; therefore it could be argued that leaving a deposit on a rifle is a contract to buy. So if you don't have an FAC or a 'space' for another rifle, you could be acting illegally if you do this while you're waiting for your variation (or FAC) to come through.

But if you've applied for more than one rifle in the first place, you'll have a spare 'space' to buy your new one, and can dispose of the old one at your leisure. However, most Chief Constables don't accept economy as being 'good reason', so asking for permission to buy three, simply to avoid paying the fee if you wish to change your rifle or buy another, won't generally be accepted as 'good reason'.

An approach NOT recommended is to ask for six firearms in the hope of getting three. If you can provide a good reason for each of the rifles (e.g. prone shooting, 3-P, use by your wife/son/daughter, 'scope shooting) then no Chief Constable can refuse you, but you must be clear in your mind what you want each one for.

WHAT CALIBRE?

The question goes on to ask what calibre you require, which will obviously be .22 unless you intend shooting any other rifle calibres such as 7.62. Then it asks what type of weapon, which is obviously 'rifle'. Don't be tempted to call it a target rifle because there is no such thing; a rifle is a rifle and there is nothing to stop you using any sort of rifle you like for any sort of discipline, as long as it fits within the rules of that competition.

The next two questions, 20 & 21 are inter-related. These ask about the maximum amount of ammunition you wish to hold and acquire at any one time. The second answer should be greater than the first, by a sensible amount, allowing for a buffer of, say, 250 so you don't have to run out completely before you can buy your maximum again.

You may feel that as you're only shooting a couple of 10-bull cards a week you don't actually need very much ammo. But remember that your certificate lasts for five years and during that time, if you really get the bug, you could be shooting open competitions every weekend in the summer, going to Bisley and/or Scotland, as well as shooting league cards. It's not unusual for someone to get through 1,500-2,000 rounds in a week in those circumstances.

Ammunition is usually on sale at open competitions and at Bisley, but you may prefer to stick to a brand and batch that you know works well through your rifle, so a reasonable amount to want to purchase would be 1,000, with a 'holding' allowance of 1,250 or 1,500.

Many of our top shooters have permission to purchase 5,000 rounds, and some can even have 10,000; this is because they like to buy their ammunition in batches to match their barrel and ensure consistency throughout one, or even two, seasons.

While there's nothing in law to restrict the amount of ammunition you're allowed to buy, you're unlikely to get a 5,000-round allowance with your first application, but if you show over the years that you do buy a lot of ammunition on a regular basis, then there's no reason not to ask for an increase upon renewal.

However, at today's prices 5,000 rounds is going to set you back a few hundred pounds, so you need to be fairly dedicated to invest that sort of sum, but with manufacturers and importers now offering you the opportunity to take your rifle to their factories for testing, and buy 5,000 of whatever gives the best results, it would certainly be worth considering for the future.

Another point to bear in mind is that, when it says on your certificate that you can buy 1,000 rounds of ammunition at a time, that's exactly what it means, so don't ask a dealer, or your club, to sell you any more than that. You could of course, go away and shoot some of what you bought and then go in and buy some more (even on the same day), but the seller has to sign a declaration on your FAC confirming that it won't take you over your 'holding' amount, so it's better to have a reasonable allowance in the first place.

GOOD REASON

Question 19 also asks for your reasons for acquiring the firearms and ammunition requested. Whilst the Chief Constable has to satisfy himself that your reasons are 'good', he's not interested in an essay on the delights of scoring a 'possible'! The form actually suggests 'target shooting' as being a good reason, so that's all you need say.

The next part of the question leads on from there and asks where you intend to use the firearms listed. Here the obvious answer - the name of your club - is what is required; but add the term 'and on military-authorized ranges' as well, or something similar. (All firearms ranges in this country which are open to the public, or to club members, have to be authorised by the Ministry of Defence.)

If you only mention the club or a particular range on your application, those details could form part of the conditions of your FAC; if you were then to shoot anywhere else such as at Bisley or any other range, you could be deemed to be breaking a condition of your FAC.

On part 'C' of the form, question 22 raises the thorny problem of security, because it asks where your firearms and ammunition are to be kept when not in use, and what arrangements have been made for their safekeeping.

The Law requires that you keep your firearms and ammunition secure; how you do that is really down to you, but the Firearms Acts give Chief Constables the power to interpret the word 'secure' as they wish, and most of them have decided that, for firearms, this means a steel cabinet bolted to a wall.

Some police forces insist that you keep your ammunition separate from your rifle, others are happy if you keep it in the same cabinet - you can seek advice from your club as to local preferences. A brief description of your own arrangements will suffice, as they will probably be inspected at some stage anyway.

OTHER CERTIFICATES

Part 'D' and questions 23 to 26 are interested in any firearm or shotgun certificates you have previously held, or hold.

Part 'E' of the form is asking for two referees and part 'F' is for your signature to say you have filled in the form truthfully.

The last page of the form is full of helpful guidance notes about how to fill in the form, so everything is fairly straightforward.

PHOTOGRAPHS

There are one or two rules about who are acceptable as your referees, but nothing too onerous.

Whilst on this subject, you also have to provide four photographs of yourself, two of which have to be verified by the referees as being a true likeness of you. One of these four photos will appear on your FAC; the 'signed' ones will be kept on file, and the other one will be kept as a spare in case you lose or damage your certificate.

Now you've got to the end of the form (and hopefully it didn't take you as long to fill in as it has to read this chapter), read it through carefully. It's amazing how many mistakes *are* made, and if there are any queries it could mean a delay in processing your application.

On average, Firearms Officers send back approximately 25% of all firearms applications because they've not been filled in correctly, mainly because people don't know what answers are expected of them - hence this chapter and the suggestion that you consult your club for guidance.

Do make sure that you answer all the questions with something (even if it's only 'not applicable') as blank spaces often raise more questions than they answer.

Now you've completed your form and had it countersigned, take it or post it to your local Police Headquarters with your photos and the appropriate fee.

BE PATIENT

It may seem that, having sent all the paperwork in to your local Police Headquarters, you've just launched your application into a black hole and you'll never hear anything about it again, particularly if nothing appears to happen for ages. Just remember that large organisations (and the Police are fairly large) do take time to assimilate information and to log all your details.

As public servants the Police are obliged to deal with your application, so you can rest assured that something *should* be going on. However, if you don't hear anything within a reasonable period (say 7-10 days) then a polite enquiry to the Firearms Department (in case your paperwork has gone astray) will not upset anybody.

If you've provided plenty of contact addresses and phone numbers, the next thing that is likely to happen is that someone representing the Firearms Department will ring to make an appointment to come and discuss your application.

According to the Home Office guidelines he is not supposed to turn up on your doorstep unannounced and demand entrance, but he may well be in your area and hoping to kill two birds with one stone, so obviously if it suits you then it could speed matters up if you spoke to him.

However, if you're in the bath or on your way out, then ask if he can come back another time, bearing in mind that it may be a couple of weeks before he does get back to you because of his shifts.

Some police forces use civilians to do all their running around for them and you could argue that this is a good approach because it's better for a policeman to be out patrolling the streets, rather than sitting in your house dealing with a clerical matter.

However, civilians may not have quite the same approach; if a Police Officer puts a foot wrong and you make a complaint, he gets a 'black mark' on his file and his future career could be affected, whereas civilians don't run the same career risk, particularly if they're retired police officers.

THE INTERVIEW

If someone representing your Firearms Department (Police Officer or civilian) comes to discuss your application, there's no reason why it shouldn't be a pleasant occasion - you're not on trial you've done nothing wrong, and you are quite within your rights

to pursue a legitimate and legal sport.

He is only there to send back a report as to your suitability, so he is interested in your background, and he's probably started forming an opinion on that before you've even opened your front door, because of the neighbourhood in which you live. However, that only has a very small amount of influence on your overall suitability to own a firearm.

Therefore, answer the questions honestly and pleasantly - the Police are only interested in making sure that firearms don't fall into the wrong hands, and that should be your concern as well.

Anyone who has decided to take up smallbore target rifle shooting just has to be a dedicated sportsman (or sportswoman) at heart, so your rifle is going to be a tool to do a job, rather than a weapon, and that attitude will distinguish you from the sort of person who is after a Firearm Certificate for dubious reasons.

SECURITY

During the visit he/she may wish to have a look in more detail at the security which you've described on your application form.

If you decide to keep your ammunition separate from your rifle, it's not really necessary to go for another elaborate and expensive steel security cabinet just for a few rounds of .22. You'll probably find that keeping it in a locked box or cupboard will be acceptable.

Remember that the quantity of ammunition you're allowed to hold has no bearing on the type of security required; 5,000 rounds is no more likely to be stolen than 50 rounds - in fact exactly the opposite could be the case, as a 5,000 box of .22 ammo weighs some 30 lbs.

Therefore, if you *did* decide to keep 5,000 rounds with your rifle it would actually make it *more* difficult for a thief to rip the cabinet off the wall and make off with it (all the Police would have to do would be to search the hospitals for recent hernia admissions).

If you're clever enough (or you know a man who is) there's nothing to stop you constructing your own cabinet; however, there is a British Standard for gun cabinets - they should be capable of resisting the attack of an ill-equipped thief for at least five minutes.

The average handyman capable of welding steel plate could, without much effort, exceed that specification considerably, but on the whole the Police prefer to see commercially-made cabinets (2mm thick steel, 7-lever locks, concealed hinges, anti-jemmy bars, anti-drill plates, close-fitting recessed doors, etc., etc.).

Commercially-made cabinets are readily available from most gunshops but, be warned: when someone says they have a 3-gun cabinet in stock, they mean it will hold three shotguns.

Although there's no difference between rifle and shotgun cabinets as far as technical specifications are concerned, you'll generally find that it could be a tight squeeze getting more than one target rifle into a '3-gun' cabinet, so go for something that allows plenty of room for sights, butt hook, etc.

The main point of the exercise is to stop an opportunist thief armed with nothing more than a large screwdriver, looking for your DVD player and family jewels, from getting to your rifle; the determined professional will come prepared to break into even the most secure of cabinets.

If the Police don't think your security is adequate then they will say so on their report to the Chief Constable; therefore it's down to you to persuade them that it is.

CLUB MEMBERSHIP

It's also at this stage that you may be asked for further details as to where you're going to shoot. If you belong to a club, they are obliged to have regular use of a range, reasonably locally and covered by a current Ministry of Defence safety certificate, so your very membership will prove that you have somewhere acceptable to shoot.

You may be asked to prove that you have *bona fide* club membership. Many clubs provide you with a membership card, but they are not obliged to do so, so if you don't have anything like that, make sure you have available the name and phone number or address of the Club Secretary so that the Police can confirm your membership with them.

After the visit your certificate should arrive in the post in due course, unless there are any queries to be resolved.

It's worth pointing out here that, if you run into problems with your application because you don't meet one of the Police's criteria (e.g. security, wrong sort of referee), they may suggest that they put things on 'hold' while you sort it out.

Here they are probably trying to be helpful by giving you the chance to update your application, rather than you having the embarrassment of a refusal which you would then have to declare on a future application.

Once you've allowed a suitable amount of time for the grinding machinery of a large institution to take its course, you could enquire as to the whereabouts of your FAC.

If, after a further 7-10 days it hasn't appeared, it wouldn't be unreasonable for you to make further enquiries, in case it's gone astray in the post. It's not uncommon for FACs to be sent out by second class post in window envelopes which show what's inside - not the best form of security for such an important document!

ON RECEIPT

When you receive your certificate, the first thing you must do is sign it - it is not valid until you do, but it's amazing how many people forget. Do also check that the certificate has been signed by the Police - again, it's not valid if *they've* forgotten to sign it!

Next, check it carefully - it's not unknown for mistakes to occur as to the type of weapons, quantity of ammunition, period of validity, your date of birth, etc. There will be certain conditions printed on the form (primarily concerning 'authorised ranges') but there should be no unreasonable conditions, unless you are a special case and have specifically agreed to them. If you find anything wrong, phone your Firearms Department immediately.

Remember that if you break any condition which is shown on your FAC, it could mean the loss of your licence, so now is the time to check that you're able to comply with all the conditions printed on it. If you have any doubts about anything, check with your Club Committee, fellow club members, local gunshop or your Firearms Department.

Now that you've received your certificate, it is a good idea to have it with you whenever you're carrying firearms or ammunition (and make sure that you don't exceed your ammunition allowance); don't be tempted to carry anyone else's weapon around just because you now have a certificate - that's not permitted.

Your certificate gives you the authority to purchase or acquire a certain number of firearms. When you go to buy a gun, the dealer or private seller should write all the details of the gun onto your certificate, together with the details of his certificate; check that the details entered are correct, to save embarrassment later.

If you're buying from a dealer, he will also enter your details onto his register with a description of the firearm, and will then inform your local Police that you have acquired that weapon. You also have to inform the Police that you have acquired one of your permitted rifles and who you got it from.

Every time you purchase ammunition, the seller will enter the quantity purchased onto your certificate (try to get them to write fairly small, as there's not a lot of space to cover 5 years!), but you don't have to inform the Police every time.

Once you've purchased as many weapons as your FAC allows, you can't buy any more without getting permission from the Police first, so if you only have permission to buy

one gun, then that's all you're allowed to acquire.

VARIATIONS

If you then decide that you don't like that particular model and want to sell it, or give it away so that you can acquire another one, you have to dispose of your original weapon. Then you must go to the Police with your certificate, and another completed application form 101 (but without photos or countersignature this time).

They will then remove your original gun from the certificate and give you permission to acquire another one. Luckily this sort of variation (known as a 'one-for-one') shouldn't cost you anything.

If you're going to part exchange your old rifle for a new one through a shop, then the Registered Firearms Dealer will give you a receipt for your old gun, to show that he's taken possession of it. You can then take that receipt to the Police with your FAC and completed form 101 as above, to get permission to acquire another, so that you can go back to the shop and collect your new rifle.

A 'one-for-one' variation is purely a clerical exercise, and many Firearms Departments should be able to do it while you wait.

If you sell to a fellow club member or other private individual, you should get a receipt from him, and make a note of his name, address, FAC number and date of issue; you can then apply for a 'one-for-one' variation as above.

You must remember that if you dispose of a firearm by any means at all - and that includes losing it - then you must inform the Chief Officer of Police within seven days.

It all seems very complicated, and some aspects may seem pointless, but unfortunately it is the Law, so it's important to get the procedures right and not get a 'black mark' on your file.

However, don't worry, you can always ask your Firearms Department for guidance - they *are* there to help.

CHAPTER 5 BUYING YOUR FIRST RIFLE

BUYING YOUR FIRST RIFLE

Now you've received your first Firearm Certificate, signed it in the appropriate space, checked the Police have given you what you've asked for and shuddered once again at the photo on it, you're off hot-foot to the nearest gunshop to examine their wares and acquire your first target rifle.

You've probably received lots of good advice from your fellow club members about what to purchase, but just in case you're a bit confused by all the conflicting advice you've received, here are some guidelines to clear the fog and summarise the likely availability and suitability of some of the rifles you may come across in your search.

GUNSHOPS

First find your gunshop. Out of some 400 gunshops in the country, only a handful specialise in any way in .22 target rifle shooting equipment. That's not to say that the other shops won't have anything to tempt you (in fact some good bargains can often be found in a shop that has taken a target rifle in part exchange for a shotgun, without realising what they've bought), it's just that the specialist will have more of a selection and should have some expert advice to go with it.

It's just like buying equipment from a golf pro - he may not be the cheapest but it's more than his reputation's worth to let you go out of his shop with the wrong set of clubs; so it is with the specialist target shop - the smallbore shooting world is very small and bad news travels fast, so the expert is not going to want his reputation tarnished by letting you buy the wrong equipment.

Therefore, start your search at the shops who advertise - or are known to be involved in - .22 target rifle shooting. If you can't find anything suitable there, you can always spread your net further afield at a later date.

RIFLE TYPES

There is no definition of exactly what you should be looking for because a good shooter can shoot with anything, but here are a few pointers in the right direction. First of all let's look at what you might come across in your search.

There will be some BSA Martini actions about, in various models, and most of you will probably already be familiar with these as lots of clubs have them as club rifles. They range from the little model 12 (made in the 'Thirties), up to the Mark V International which was produced up until about 1985.

The Mark I and Mark II Internationals had fixed barrels, whereas the Mark III was the first model with a fully-floating one, i.e. the barrel was clamped rigidly into the action and the forend was bolted to a beam which cantilevered out from the bottom of the action, parallel and very close to (but not touching) the barrel. The Mark IV and Mark V went back to having the forend fixed to the barrel, and the Mark IV also had a lightweight barrel.

Without a doubt the BSA rifles were superb pieces of kit, and in the hands of a good shot they could perform brilliantly - in some cases they still do.

If you come across any of them, you'll probably be most impressed with the solid way they're built, but you may be disappointed with their lack of adjustments.

Back in the 'Fifties and 'Sixties there were all sorts of rifles in use - BSA, Winchester, Finnish Lion, Remington and even the odd occasional Anschutz. Nowadays things have changed somewhat and the majority of smallbore shooters use Anschutz.

A fairly early decision you'll have to make is whether you're going to prefer a bolt action or a Martini action. As the modern prone shooting position tends to involve laying at a much smaller angle to the firing point than the old military-style position of 45 degrees, and the recommended reloading technique means lifting your elbow completely off the ground instead of rolling over, then this all points towards using a bolt action. (However, there is some question as to which comes first, the rifle or the position.)

If you decide to look for a bolt action, then there is still a wide range of manufacturers to choose from: Anschutz, Walther and Feinwerkbau, all produce new rifles.

On the secondhand market you will still come across Vostock or Ural (both Russian), Hammerli (Swiss), Diana (German), Unique (French) or the Finnish Lion.

As this is your first Firearm Certificate you're likely to be looking for a rifle to give you good accurate service for the next few years without necessarily expecting it to take you to the next Olympics.

This gives you a fairly wide choice, because if you've been shooting with a club rifle up until now, anything you acquire is likely to be an improvement, because you can set it up specifically for yourself without having to worry about anybody else making adjustments to it while you're not there.

As a broad rule of thumb, when choosing a rifle go for a heavyweight barrel if you're a man (or a fairly strong lady or junior). If however you're a lady of more delicate structure, or a young slip of a thing, then you might find the lighter weight barrels a lot easier to cope with.

If you're used to shooting a very heavy club rifle such as the BSA Mark II International, then you'll certainly cope with anything you find on the open market, but if you've found something like that to be unmanageable, look out for something lighter.

Anschutz actually produce some very lightweight rifles, so if weight is a real problem because you're slightly built or have an injury or weakness, then it's probably worth looking for one of these.

BARGAINS

The best bargains are to be found in the clubs, where rifles often change hands amongst members, but if you belong to a fairly small club you may have quite a wait.

The beauty of buying from a fellow club member is that you can try the gun before you buy it, although don't place too much emphasis on the importance of this because it's going to take several months of settling in before you have it set up correctly. The way a rifle has performed in the hands of one shooter is no guarantee that it will perform the same way when *you* use it, but at least if it's been shooting well then there's unlikely to be anything major wrong with it.

The specialist shooting magazines do take private advertisements and this could be a safe alternative for both buyer and seller.

There's nothing to stop you buying a rifle from another club member, but do make sure that you get the paperwork right. The seller must fill in the appropriate sections on your Firearm Certificate, giving a description of the rifle and details of his own FAC; he must then inform your Police Headquarters of the transaction. *You* also have to inform the police that you have acquired your rifle.

THE COST

The first thing you'll probably notice when investigating rifles and their cost is the wide variety of prices: from £50 to £2,000.

Obviously the old saying of *caveat emptor* (buyer beware) applies as much in shooting as in any other business, and you do get what you pay for. If you're in the happy position of being able to say that money is no object then go for the best, and that usually means the most expensive.

These days the world of manufacturing, distributing and retailing is so competitive that nobody can afford to market a product that is overpriced, so if you're shown a rifle costing £2,000 it's a fair bet that it will be worth twice as much as one costing £1,000. What it doesn't mean, however, is that you'll shoot twice as well with it.

If you decide that you'll wait for that incredible bargain of an almost new rifle with

only one careful lady owner, at half price, you could find yourself waiting forever.

LEFT HAND

Left-handers trying to buy secondhand will find life quite difficult, as Anschutz are really the only people making a true left-handed rifle which is readily available these days, and they've only been doing that since about 1981, which means that there aren't all that many in circulation generally.

Other continental manufacturers have made some left-stocked models but generally these have a right handed bolt and action and you may also find the sights are right-handed. BSA made several true left-handed models (the model 12 was ambidextrous), so you may stand more of a chance of finding one of these, but even they are becoming scarce now. However, secondhand left-handed rifles *can* still be found, but it may take longer and you may have to travel further afield.

The quickest way to learn which is the right rifle for you is to buy one, then see how you get on with it. It might sound like an expensive way to learn, but in fact it isn't.

NEW OR SECONDHAND

If you buy a secondhand rifle at its market price and find after a couple of years that you don't get on with it, then you can probably sell it to a fellow club member for the same price again, provided you haven't done anything drastic to alter it while you've had it.

If you buy a new rifle, as soon as you get it out of the shop it becomes secondhand and, therefore, only worth about two thirds of what you paid for it. But, by buying a new rifle you do get one untouched by any previous owner and, like buying a new car, you get a wonderful feeling of pride in ownership.

That's not to say that you can't get satisfaction from a secondhand rifle and, as most new rifles these days are well in excess of £1,500, secondhand is the route most new shooters take.

Whether you're buying a secondhand rifle from a shop or from a friend, don't be afraid to ask questions about its history. The owner may not be able to tell you exactly how many rounds it's fired, but at least he should be able to give you an idea of its age, and what sort of shooting he's been doing with it recently.

HISTORY

If it's a one-owner rifle then you can expect a full history, but obviously if there have been several owners you can only expect its more recent history, but even that can be quite enlightening.

Let's assume that the average club member shoots 3 winter leagues, that could mean 10 cards x 10 shots + 5 sighters in 3 leagues, and supposing he does 10 practice cards, that could all amount to about 600 rounds in a winter season.

Now supposing he does a couple of summer outdoor leagues, say 10 rounds of 40 shots plus 10 sighters in 2 leagues, and allow 10 cards of 25 shots at practice. That could amount to 1500 rounds, so in total an average shooter could get through some 2,000+ rounds a year.

Anybody who only shoots a few indoor cards in the winter may only shoot a few hundred rounds, whereas the aspiring 'international' may be using 5,000 rounds a year, or more.

Having some information about the previous owner(s) and the actual age of the rifle, could enable you to work out approximately how many rounds your proposed purchase has fired.

Some rifles have shot more than 100,000 rounds and have still been able to hold a reasonable group, so there is no need to have any great concern over a rifle that is, say, even 30 years old.

Older rifles tend to be cheaper - in fact you'll probably find that there's a direct relationship between age and price. However, when rifles are new, there tends to be a great difference between the prices of the various models, but as those rifles get older then that difference is eroded.

The thing which has the greatest influence on price is the popularity of the model, so for example, you will have to pay a lot for any Anschutz 1913 or 2013 of any age because they are most sought after, and there aren't very many available on the secondhand market.

CONDITION

The first thing to take into account is the general overall appearance and outside condition of the gun relative to its age.

If you're considering buying a Mark II BSA because that's the limit of your monetary resources, then you should make allowance for the fact that the rifle is very old, and no matter how well it's been looked after, it's bound to have suffered some knocks and scratches. If, however, you're looking at a secondhand Anschutz 1913 or 2013 which is only a couple of years old, then you would expect it to be near perfect.

People don't usually buy a brand new top-of-the-range target rifle and then treat it like a garden implement, so you can let your first impression be a good guide. Look for any serious dents in the woodwork - the rifle could have fallen over at some time in its life, which could lead to one or two problems.

Modern bolt action rifles with a very low cut-out behind the pistol grip have a tendency to break across the 'wrist' because the stock is very weak at that point. Any rifle which has fallen over may have a cracked stock, so examine that area very carefully, looking out for hairline cracks or signs of movement in the wood as you handle it.



The weak part of a stock

A well-repaired stock is no hindrance, as can be testified by Malcolm Cooper some years ago; he won Olympic Gold with a rifle whose stock had been broken by a TV camera crew and skilfully repaired at the Games, and, more recently at the 1994 Commonwealth Games Susan Hartop's rifle arrived in Canada with its stock in two pieces; once it was repaired, she went on to win the pre-Games badge match with a personal best score.

In fact, there's very little that can't be repaired on a .22 target rifle (although some BSAs are causing a problem now) but you don't want to be unexpectedly adding the cost of a repair to your purchase price.

Rust on a barrel is unsightly but not necessarily detrimental to its overall performance, but it is an indication of neglect by one of its previous owners, who may

have neglected other areas.

If the rust appears as small pinpricks on an area where somebody may have been carrying the rifle (e.g. across the top of the breech) then that's unlikely to be much of a problem, but if there are signs of more general rust, that is symptomatic of poor storage conditions, and the rot could be much more extensive.

Of course, if somebody is trying to sell you a rifle, they will probably have rubbed all the rust off, but it will still show beneath the oily coating as a series of small pinpricks, although you may have to look very closely to see these.

But even rust can be dealt with so don't dismiss the rifle out of hand, because a good gunsmith can re-blue a barrel for £35-£50, which will make it look like new.

One area which could be affected by rust is underneath the receiver (in a bolt-action rifle). Because metal is in contact with wood here, if the rifle has got wet at any time (and who hasn't been caught out shooting in a heavy shower at some time or other?) then it's possible that the underside of the action has become corroded.

In serious cases that could affect the stability of the bedding, with a possible effect on accuracy, but small areas of surface rust are not really a problem - just keep your eye on them. However, don't be too enthusiastic in that area with mineral oils, as they don't do the woodwork a lot of good. It's better to make sure that the wood is well sealed there so that no moisture can escape from it and affect the metal.

BULGED BARRELS

The biggest repair you're likely to come across is fitting a new barrel onto a rifle, which can be extremely expensive. However, if you're buying from a Registered Firearms Dealer that's fairly unlikely to happen because he's bound very strongly by the Proof Act and if he sells you a rifle with a bulged barrel (which would mean it's 'out of proof') then he's breaking the Law and is in serious trouble.

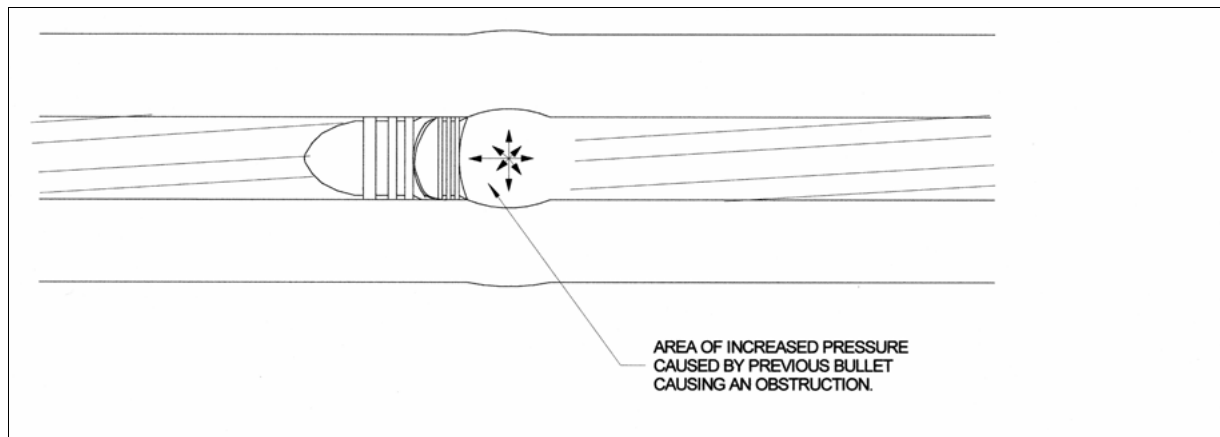
It's also against the law for a private seller to sell an 'out of proof' firearm, but that's much more difficult to prove and the seller may be doing it unknowingly. Ignorance is no excuse of course, but how many of you out there would know whether your barrel is bulged?

You've probably heard of people managing to blow the end off of a shotgun by getting the barrels plugged with snow or mud, and you're probably thinking that would never happen to you, but that's not the only way to bulge a barrel.

What is much more likely to happen in a firearm is that a bullet doesn't leave the barrel (probably because of lack of powder in the case) and then another round is fired behind it. At the collision point between the two bullets there is an enormous amount of hydraulic pressure - the lead literally acts like a liquid under extreme

pressure.

That pressure is enough to stretch the steel at the place beyond its 'point of elasticity' and it stays stretched, creating a bulge which forms as a ring inside the barrel.



Colliding bullets tend to bulge barrels

Before you raise your eyebrows in disbelief, ask yourself how many times you've fired a shot which you couldn't find on the target. That in itself doesn't mean that the bullet didn't exit the barrel, as it may have gone through an existing hole, or not reached the target at all; however, if the recoil felt different, then you should have been suspicious.

A change in recoil may not be particularly noticeable, as the recoil and sound from a .22 are so low anyway, but if you then get another shot which sounds louder, or produces more recoil, and a hole doesn't appear on the target at all, or appears a long way away from the group, then you may have just bulged your barrel.

As a buyer you would be well advised to check before you commit yourself to buying a rifle, but how do you go about that?

In another chapter on cleaning you will find details of some small cleaning felts which go on the end of a cleaning rod. These are only about 10mm long and the idea is to push one slowly and carefully down a barrel; if there is a bulge, the felt will suddenly leap forward across the gap and you'll notice a change in the resistance to your pushing. If the barrel is dirty you'll need to clean it first so that the felt moves fairly smoothly, as a change in resistance could be caused by dirt.

It's also possible to see a bulge on the outside of the barrel; if you hold it up to the light so that you can see a line of light reflected in the oil on the outside, a bulge will show as a break in that line.

It wouldn't be impossible for a barrel to have more than one bulge in it in different places, but Heaven knows what it will shoot like. It's a fairly safe bet that a bulge doesn't *improve* your shooting, but no-one knows exactly *how* detrimental that effect is.

Some people can pinpoint a downturn in their scores to a time when they realised afterwards that a bulge must have occurred, others have been shooting after they've unknowingly bulged their barrel and haven't noticed any change to their scores.

As .22 rifle shooters are the most genuine and honest people, no-one would deliberately try to sell you a rifle with a bulge in the barrel, but some people have bulged barrels without knowing it.

Before the target shooting world descends into a quivering mass of tearful shooters desperately praying for some divine intervention in the natural laws of physics to exclude them from the possibility of a bulged barrel, let's lighten the burden for you.

Firstly, bulged barrels are more likely to be found in old rifles because of the greater number of rounds fired.

Secondly, if the owner regularly cleaned his barrel he is much more likely to have realised that something is wrong.

Thirdly, the more expensive rifles (which are more likely to have been shot by the better shooters) are less likely to be bulged because top grade ammunition will probably have been used most of the time, and this is less likely to produce a 'dud' round.

Fourthly, these top shooters are more likely to notice the difference in recoil and sound of a round not being quite right and will do something about it before anything untoward happens.

Fifthly, an estimate of the likelihood of a bulged barrel being offered to you is one in several hundred - they're not an everyday occurrence.

So now you can relax a bit, but if you are buying a secondhand rifle from somebody - check the barrel as your main priority!

THE SIGHTS

Next, examine any sights on the rifle for signs of damage or twisting.

If you look at a rearsight from the muzzle end, the aperture should be in the middle of the frame. If it's off to one side to any great extent such that it's within 20 or so clicks of one edge, that could indicate that something's wrong. It could also lead to problems on a very windy range (like Bisley), when you might run out of windage

adjustment.

The problem could be a twisted sight, caused by it sustaining a knock, or having fallen over at some time, so if everything looks square and central don't worry about it, but if anything looks out of alignment - check it.

Be wary of chewed up screw heads - in themselves not enough to stop you buying a rifle, but they do indicate a certain lack of care which might mean some other things haven't been carefully looked after.

If the rifle has been re-bedded at some time in its past life then that can be a sign that the shooter was keen to get the best out of the rifle, and could mean it will shoot well. Notice the predominance of 'can' and 'could' in that previous sentence. Good bedding is a bonus - poor bedding might be a hindrance.

THE OWNER

As much a guide as anything is the owner himself. Were he a good shot? If so then the rifle must have been good. That's not to say that it still is, but it can be a good guide.

One careful owner can add pounds to the value of a rifle, not just because it looks better but also because it means there's less likely to be anything wrong with it. Careful owners don't knock their rifles about.

It is nice to see the original manual still with the rifle - not because you'll particularly need it, more that it's an indication of a careful owner; the same applies to any of the tools that would have come when the rifle was new.

There may even be some extras included, like an adjustable iris or a foresight bubble or any other little thing the owner might have fitted to make their life easier. These sorts of extras don't add a lot to the value of the rifle because you may not necessarily have bought them for yourself, but they can make the rifle more of a bargain.

There may be a carrying case included, which definitely adds to the value, particularly if it's a good quality hard case.

Ultimately the choice is yours but you can't go far wrong as long as you don't buy something nobody else has ever heard of. Stick to the popular makes because there are more parts available and they're easier to fix.

If resale value bothers you, then look round the clubroom to see what everybody else is using and that will give you a clue as to what is popular. If you buy a popular model you won't have any problems when you come to trade it in for a new model.

CHAPTER 6 CLOTHING

SHOOTING CLOTHING

What would a complete stranger to the sport think if he unexpectedly came across a smallbore target rifle shooter dressed in all their shooting clothing? To the uninitiated - and even to the newcomer to the sport - it must seem to consist of a bewildering array of accoutrements.

What he wouldn't realise is that all the equipment and clothing now in use has been developed and refined over the years.

In the early days of rifle shooting you were expected to shoot in your ordinary street clothes. Using properly designed clothing would probably been seen as being unsportsmanlike in this country, but as with most other sports, technology has reared its ugly head and taken over.

The benefits to be gained from proper-fitting clothing designed for shooting can't be ignored. The rules allow a certain amount of support to be gained from clothing, and shooters, quite rightly, wish to take advantage of this; if you don't you're at a disadvantage (which could cost you points).

However, don't dash down to your local gun shop and buy every item of shooting clothing you can find - each piece of equipment has to be bought with care, and with a certain amount of research.

GLOVES

Before choosing a glove it's important to understand *why* you might need one at all.

Supporting the rifle with the bare hand becomes uncomfortable after a short while because of the pressure from the handstop and the sling. You also transfer your pulse beat through bare flesh and a pulse beat will cause an unsteady aim even if you can't see that tremor.

We seem to get nine months of cold weather in this country and only three months of warm, so a glove which contributes to keeping your hand warm is an asset. You have no means of massaging that hand or doing any of the things you would normally do to warm it up when it gets cold, so you have to lay there with your hand motionless; therefore it gets very cold.

The skin of your hand is also loose and doesn't have a particularly sticky texture (or at least it shouldn't have) so your bare hand could move or shift slightly while you're shooting. A glove, on the other hand (pun!), will be

covered in a non-slippery surface and will stick to the rifle, reducing any possibility of movement.

Choosing a glove can be a traumatic experience simply because of the overwhelming choice of colours and designs, but your decision must be based on fit and comfort.

Gloves come in a number of styles, but the modern favourite is a well-padded five-finger one, with non-slip patches all round the outside. They range in price from about £20 to £50 (at 2004 prices), and the variation in cost is going to be down principally to the type of materials used and country of manufacture.



A pair of gloves

Of course, hands come in different shapes and sizes, but there aren't quite the extremes that you get with body shapes, so although gloves obviously have to fit well, they only usually come in small, medium, large and extra large sizes, so you can't get a glove made-to-measure.

If you're asked to provide a measurement for a glove (because you're buying one mail order for example), then that's usually taken by wrapping a tape measure around the widest part of the palm and quoting the total circumference. It would also be a good idea to discuss finger length at the same time if you're unable to try the glove on.

The most basic glove might be little more than a fingerless leather mitt just barely covering the palm of the hand, but even that is considerably more comfortable than the bare hand.

The fit of the glove is important, so time spent trying them on before you purchase is time well spent.

Make sure that none of your fingers reaches the end inside, even when pushing the glove down as hard as you can, otherwise when you're shooting there will be intense pressure on the end of your fingers, which can be really painful.

The glove should be of just such a size that you can hold your hand out absolutely flat without feeling that it's restricting that movement. However, you shouldn't be able to get hold of any spare material across the width of your palm.

It should be a bit of a struggle to get the glove on for the first time; that's because they're usually quite well padded and that padding will compress slightly during use. If the glove slips on easily when new, it will be too big after a while.

Most gloves will have an elasticated cuff which will also make it slightly difficult to pull on, but persevere - it will get easier.

You can't beat being comfortable while you're shooting and there's nothing in the rules which says you have to be uncomfortable, so you may as well treat yourself to the luxury of the most comfortable glove you can find. It will ease the pressure on your hand, keep your pulse beat away from the rifle, and keep your hand warm.

HATS

Shooting hats come in a wide variety of colours, but there isn't much variation in design. Nearly all of them consist of a cap with a long peak, and side flaps which drop down, all of which can be a tremendous help in blocking out unwanted light and distracting movement, particularly when shooting indoors.



A hat

Usually they come in one size (which is adjustable), with some form of fixing at the back. When trying hats on don't make the mistake that most people do when they first put one on: the hat should go on the *back* of the head, *not* pulled down low over the forehead.

When you're in the prone position you're usually looking out the top of your eyeball, because your head is bent forwards, therefore the peak needs to be up and out of the way. It also needs to be above the rearsight of your rifle and that also means it has to be high on your forehead.

Outdoors is another story; here it's more important to have general all-round unobstructed vision to enable you to see and read wind conditions. However, you have to decide whether you're likely to lose more points by wearing a hat and not being able to see all the wind flags, or whether *not* wearing a hat (and allowing the low Spring or Autumn sun to distort your sight picture) will have a worse effect. It's not easy, is it?

If you have to stand around in the sun before you shoot, do consider wearing a hat so as to avoid sunstroke-type problems.

In short, be prepared for all eventualities, remain flexible, and weigh up the advantages and disadvantages of each individual set of circumstances.

A sweatband is another useful piece of equipment at fairly small cost. It keeps any hair out of your eyes and away from the rearsight, it can hold a small eye blinder (ammo box lid!) if necessary and, course, it absorbs sweat and stops it running into your eyes in very hot weather.

It can also hold your Bisley competitor number and, last but not least, you can sew a lens-holder onto it if you need a corrective lens but can't get on with (or afford) shooting frames.

Don't choose too tight a headband, though, as it could give you a headache, and remember that you lose 10% of your body heat through the top of your head, so in very cold weather wear a woolly hat (or something similar) as well!

JACKETS

This is probably one of the biggest and most expensive purchases you will make (after the rifle), and a bit of research would be worthwhile, so as not to waste money on the wrong thing. It is also probably the most effective piece of equipment you will buy, after your own rifle.

The biggest and best source of information can be fellow club members: look and see what types of jackets they're wearing and ask them what they think of them. If you're in a small club without very much variety in shooting jackets,

have a look round the open shoots, or even better, go to the smallbore meeting at Bisley - you'll be amazed at the selection of styles available. Be warned, however, that jackets in particular are subject to fads and fashions and while they don't exactly feature on the catwalks of the Paris fashion houses, they do tend to appear in trends.



A typical rifle shooting jacket

Very often a club member will sport a new jacket, which immediately attracts the interest and envy of other members and, before you know where you are, there are several new patchwork quilts walking the ranges. There's nothing wrong with that at all - in fact the modern trend towards brightly-coloured jackets is certainly livening up the image of smallbore target rifle shooting, which has been a hide-in-the-corner-type sport for far too long. But how do you go about choosing the right jacket?

Many people start with secondhand cast-offs generously donated by other club members, so if you're a beginner looking for something to ease the pain in the elbows, *any* jacket with padding is going to make life more comfortable.

When you move on from that stage and are looking for a jacket to get you into X Class, then I'm afraid you're going to have to spend some money, but a good, proper-fitting jacket could last for many years, so look upon it as an investment. However, if you're committing yourself to spending a lot of money on a new jacket, you should consider having it made to measure. No two shooters are the same size (just look round the club and compare people's heights and girths!), so standard-sized jackets are very rarely going to fit exactly.

You're allowed to get support from a jacket, but you won't get that unless the jacket fits you properly; it's no good, for example, being able to move around inside it - if you can, then you stand no chance of maintaining a consistent stable position.

It's amazing how the body's tendency to grow can catch you unawares (particularly after Christmas), and it's not unusual to see some shooters contorting themselves to get into their jackets. At least if your jacket *is* too tight you know you won't be moving around inside it while you're shooting!

The *International Shooting Union* (U.I.T) rules also need to be considered. These dictate, amongst other things, that there must be a certain amount of overlap at the front of the jacket (currently 70mm, but this can change).

Therefore, if you're likely to be shooting under U.I.T. rules (which cover most international competitions, but very few club or national events) it's worthwhile keeping up to date with any changes relating to clothing or equipment to make sure that the jacket you buy complies with the rules.

Most continental jackets are automatically made to meet U.I.T. specifications (i.e. the manufacturers add on an allowance for the required overlap), whereas if you have a jacket made to measure by a British manufacturer, you can often choose U.I.T. or non-U.I.T., the main difference being that, with non-U.I.T. you get a bit more padding in the elbows, a pocket at the back, and a tighter jacket generally.

All club, county and national league shooting is conducted under the *National Smallbore Rifle Association's* rules, as are the Bisley and Scottish national meetings and most open shoots. Therefore, if you only shoot in this type of competition, there's no need to worry whether your jacket complies with U.I.T. rules.

There are a number of extremely good well-made jackets readily available and most of them can be 'made-to-measure' at no extra cost. If you suffer from the 'non-average size' syndrome then you'll have to get a made-to-measure jacket. There's no point in buying a jacket that doesn't fit properly - you're just wasting money.

As a stop-gap until you can afford a top jacket, you may have to make do with something that isn't ideal, or if you're a teenager with a huge growth rate then off-the-peg is reasonable; just be aware that, unless the jacket fits well enough to support you, it won't be doing its job properly.

The basic material of the jacket will be the first decision to be made, and your budget will probably have some say in the matter here. A good basic British

double canvas jacket, made-to-measure including a sling retaining loop and non-slip elbow pads will probably be about one third of the cost of a leather one made on the Continent.

The first question that springs to mind is “why is there such a price difference?” quickly followed by “which one is best?”.

The price variance is mostly down to cost of materials, which is borne out by the fact that one British manufacturer of a double canvas jacket also produces a leather one (with canvas lining) in the same design for nearly twice the price. With Continental-made jackets, the exchange rate is also a factor.

As to which one is the best, that’s almost impossible to answer, apart from in general terms like “you get what you pay for” and “the better the jacket fits you the more improvement there will be in your shooting”.

To do your shooting any good at all, the jacket you choose must have a non-stretch heavy canvas lining to give you support in the shooting position, but what you have on the outside *is* a matter of personal preference (and finances).

Obviously, the weight of leather in the jacket will be a guide to its strength, rigidity and endurance, so a (cheaper) sheepskin leather on the outside will not last as long or wear as well as a good cowhide. However it’s the canvas lining which is doing most of the work, so although a cheaper leather jacket may begin to look somewhat worn after a while, it won’t necessarily cause you any problems.

Because canvas is cheaper than leather, if this is put on the outside of the jacket then you can save money without sacrificing toughness and support - hence the double canvas jacket.

There are a number of other factors which require special attention, particularly in places like the elbows (inside and outside), the position of the sling loop, and a shoulder pad to take the rifle butt.

The part of the sleeve which falls within the crook of the arm, should be of a much thinner and more pliable material than the jacket itself, so that the arms can be bent comfortably. Different manufacturers use different materials and it doesn’t really matter what the material is, so long as it doesn’t prevent the arms from being bent comfortably.

Elbow pads should obviously be non-slip and can be padded; once again the U.I.T. have a thickness rule here, but if you only shoot under NSRA rules, then don’t worry too much, and, as mentioned earlier, you’re unlikely to buy something which doesn’t conform with the rules unless you specifically ask for

it (as with some of the British-made jackets).



Soft material inside elbow and rubber outside

Another major decision to make concerns the front fastening, i.e. whether to have a zip or buttons. Buttons are the favourite, particularly the type which screw together through the jacket. All that is required is for a hole to be punched in the right place (which most people can manage) and it beats all that sewing if the button comes off; it also helps enormously if you do happen to put on (or lose) weight.

Some manufacturers actually send little screw-in buttons loose with the jacket so you can fix them yourself. However, if you have one of these jackets, fixing the buttons is not something to rush into, particularly if you shoot 3-positional, as a button which may be right for the prone position could be completely wrong for kneeling, etc. Also, you may need to take the U.I.T. 'overlap' rule into account.

The best way of tackling this is to enlist the assistance of a club member who can mark the jacket while you're in the shooting position; it should pull together fairly high at the top, because if it's loose it can affect how the rifle butt fits in the shoulder.

A jacket, which is cut too low at the front, is likely to gape when in the prone position, so much so that the rifle actually ends up in your shoulder *inside* the jacket. Loose material (particularly in the prone position) is also bad news, as it can move around, taking your rifle butt with it.

Don't dismiss a zipped jacket as being unsuitable - it's just that buttons can be moved more easily. However, if you do end up with a zipped jacket, look for one that opens at the bottom as well as the top; this is mainly for the benefit of the 3-P shooters in the kneeling position, but it does also help prone shooters get up and down.

You should choose a jacket as long as is permissible under U.I.T. rules (currently to the ball of your clenched fist) because that helps prevent it from riding up when you're shooting prone - the more of the jacket you lay on, the more chance there is of it staying still.

It also means that you're less likely to shuffle down inside it, which you would do if you positioned your elbows correctly and then moved backwards on the mat like a tortoise retreating into its shell. This would create a great deal of loose material around the back of the neck and in the shoulder - although this is inevitable to a certain extent, you should avoid it as much as possible.

This also brings up another very important design feature, in that the jacket should be cut very low around the back of the neck. If it's too high then it may dig into the back of your neck (even if you haven't shuffled down inside it), interfering with your blood circulation and, consequently, your vision. All jackets should have a soft flexible piece at the back to stop them being a pain in the neck.

Some jackets have straps which can be tightened to take up the loose material in the shoulder when in the prone position; this is a particularly good idea for 3-P shooters (whose jackets are cut slightly differently) because there's an enormous difference between the standing and prone shoulder positions.



The straps tighten up loose material

Having invested in a new made-to-measure jacket, don't worry too much if it feels very tight when you first try it on. Just lift your arms above your head (which is where they are effectively when you're shooting prone) and you'll probably find that it loosens off considerably across the chest.

It may feel tight elsewhere, but after a while the jacket will take on your form and, while it doesn't exactly stretch, it does at least fit better after it's been worn a few times. If you're collecting your jacket from a shop then see if you

can lay on the floor with a rifle and check whether the elbow pads are in the right place.

Most jacket manufacturers have self measurement forms so if you're going to 'do it yourself', then it's important to read the instructions carefully and get at least one other person to check your measurements

A better bet would be to go to the shop supplying your jacket as they will probably be experienced in measuring lots of different people, and will know where mistakes could occur.

For example, it's not unusual for your job, or a different sport, to affect the shape of your jacket (right-handed bricklayers can have very muscular left arms; people who constantly work at a desk can be very round shouldered; rowers or weight lifters can have very muscular arms and shoulders). Someone with experience could take this into account when measuring you, and insert additional measurements if necessary.

If your local gun shop is not able to measure you, then do ring round - it might mean a journey but it will be worth the effort in the long run to get the right thing. As a matter of interest, some measurement forms give you profile sketches of different body shapes (some of which are not very flattering) and you choose the one closest to your own (not the one you would like!), in addition to providing multitude of measurements.

Shooting jackets can be altered if you happen to change shape, so don't despair if you have an ill-fitting garment. However, you might find that your local tailor doesn't have heavy enough machinery to cope with the heavyweight materials involved, so you may have to send it back to the manufacturer.

Finally, treat your jacket with care, it's an expensive item and should last you a long time; a little leather food every so often will help leather jacket, and an occasional clean of a canvas one will stop it looking too scruffy.

SWEATSHIRTS

When getting measured for a jacket you should wear your normal shooting clothing, as changing what you wear under your jacket will alter its fit; this also means, therefore, that you should stick to the same thing in winter and summer.

This, then, raises the question of what to wear and whether to invest in a proper shooting jumper.

Firstly, it's essential to wear something thicker than a normal shirt: a woolly pullover or sweatshirt is ideal, but if you do choose wool, make sure it's a fairly plain knit with no fancy ribs, particularly on the sleeves, as this could be very painful on the elbows.

Heavy canvas-lined jackets can develop creases on the inside which could bear on an important pulse, so if you wear something thick between you and the canvas, not only does it reduce the risk of a heavy pulse, but it also fills out the voids created inside the jacket and makes it fit better.

On the whole, sweatshirt material is probably the most suitable and, of course, a normal casual sweatshirt will be quite acceptable, providing it fits reasonably snugly and doesn't have too much loose material to bunch up inside your jacket, because this could become uncomfortable and cause a pulse.

There are also several different types of jumpers on the market, which are specifically designed for shooters.

The most popular type is a knitted cardigan with a full-length zip that opens at the top or bottom and with double-thickness elbows. The knitting is arranged in a tight ribbed pattern with no seams over the shoulders, and it's designed to open and close around the shooter's curves and bulges, presenting a perfectly smooth appearance without any creases.

This is by far the best, but there are others, so before making a decision you should try to have a look at them all in action and get the opinion of other wearers.

TROUSERS

The need for correct-fitting trousers is very important to the 3-P or air rifle shooter; as with the jackets, you are allowed a certain amount of support from trousers, so having the right piece of clothing for the job is a boon.

Many of the comments made previously regarding jackets also apply to trousers; be especially careful when buying them for 3-P and make sure that they fit correctly, particularly in the kneeling position (try them on in the shop when you collect them) as an ill-fitting pair of trousers can be agony.

Once again, there are U.I.T rules relating to number of zips, thickness and waistband, etc., but as most of the trousers available are made by continental manufacturers who stick strictly to U.I.T. rules, you shouldn't run into any problems here.

Most trousers can be made in the same colours as your jacket, so if you really want to brighten up your firing point you can always invest a colour co-ordinated set.

Although it's the standing and kneeling shooters who benefit from correct-fitting made-to-measure trousers, prone shooters shouldn't ignore this part of their clothing completely. I don't mean by this that you should invest in anything particularly specialist, only that it's important to be comfortable while you're shooting, so avoid anything which is too tight. (Jogging trousers are ideal because they're loose and stretchy and have elasticated waistbands, and can be heavy and warm for the winter or light and cool for the summer).

BOOTS

Boots are an enormous asset to both air rifle and 3 positional shooters - for standing and kneeling they should be considered as essential equipment. With their almost solid flat soles they are of great assistance in the standing and kneeling positions, but they are *not intended for walking in* as this bends the soles on which you rely to act as a solid platform.

You should therefore store them flat when not in use (stiffening plates are available for clamping them to), only putting them on a few minutes before you start shooting, and taking them off if you have to walk to change your cards. You should be supplied with a chair for any 3-P or air rifle competitions, so make use of it!

Most of the boots available in this country are made by continental manufacturers, so you should have no problems with them complying with the U.I.T. rules. What make or style you choose is very much a matter of personal preference; so long as they are comfortable, have an opening at the back (if you're shooting kneeling), and are easy to put on and take off, you can let your finances be your guide.

Footwear is not so important to prone shooters, and people have been seen shooting in everything from welly boots to open-toed sandals. The over-riding criterion is comfort, which involves being dry and warm and not getting cramp, so choose something which fits you well, which gives you some support, and which you don't mind getting scuffed - prone shooting can be quite hard on shoes, as the toes tend to come into contact with the ground a lot.

It would be impossible to recommend any particular type of footwear for prone shooting, but more and more people are wearing trainers, which are very comfortable while being flexible enough to cope with some of the contortions your feet get into when shooting. If you attend open shoots regularly, a pair of waterproof shoes or boots should certainly be taken along, as a sudden shower can turn an open shoot from a pleasant experience into a nightmare of cold, wet and possibly muddy feet.

CHAPTER 7 SLINGS AND HANDSTOPS

In the early days of smallbore rifle shooting everybody used two-point slings - they were wonderful contraptions, being basically a wide canvas strap which hooked to the underside of the forend and onto a point at the back behind the action (just about under your chin). Getting into a two-point sling soon separated the novices from the experienced shooters, although in fact the technique itself was really quite simple, it just wasn't immediately obvious.

If you held the rifle in your right hand (assuming you were right-handed) then the left arm had to be poked through between the sling and the rifle; the sling had to be moved until it was well above the elbow, then the left hand was swung round to the left (under the sling) and back through between the rifle and the sling, just where these two items meet.

The operation was usually carried out whilst kneeling on the floor, then all you had to do was place your left elbow on the floor and align the rest of your body behind it.

The technique of using a two-point sling involved spreading the elbows out fairly wide, which provided quite a stable and comfortable position. The problem was (and probably the reason why two-point slings are very rarely seen now) that it exerted a sideways force on the rifle, whereas it is obviously better for it to be directed as close to the centre line of the rifle as possible.

So the single-point sling was born - still hooked on to the forend, but now attached to the upper arm instead of the back of the rifle.



A modern one-piece single point sling

Early single point slings quite often involved having a separate cuff which was worn round the upper arm; so, with the sling attached to the forend of the rifle, getting into position was simple and only involved hooking the sling onto the cuff.

Gradually slings became one-piece affairs which remained attached to the upper arm and were just hooked onto a sling swivel fixed underneath the forend of the rifle. Most of the early slings were made in solid leather, so when you bought a new one, it was necessary to hang it up with a weight on the bottom to remove any possible stretchiness before it was used.

Nowadays slings are more often made from synthetic materials - mainly plastic and canvas - which are designed to be non-stretch, and which are very pliable and lightweight, whereas a leather sling would have to be very stiff and heavy in order to reduce the chance of it stretching while in use. (Synthetic slings also come in a choice of colours, but I'm sure that has no bearing on their performance!) Generally slings are all the same width (about 40mm to fit the various sling swivel attachments) but their length varies considerably.

If you're of above average height (or have particularly long arms) and you're trying to get into a low position, it would be quite possible for you to run out of sling length; there can be nothing worse than trying to cope with a sling that's too short, so this is something to watch out for.

Before going any further it might be a wise move to examine why you need a sling and what it's basically supposed to do.

One of the most important aspects of target rifle shooting is consistency, i.e. being able to repeat exactly the same conditions for each shot, which ideally means keeping body movement to an absolute minimum while in the aim, and not moving around too much in between shots.

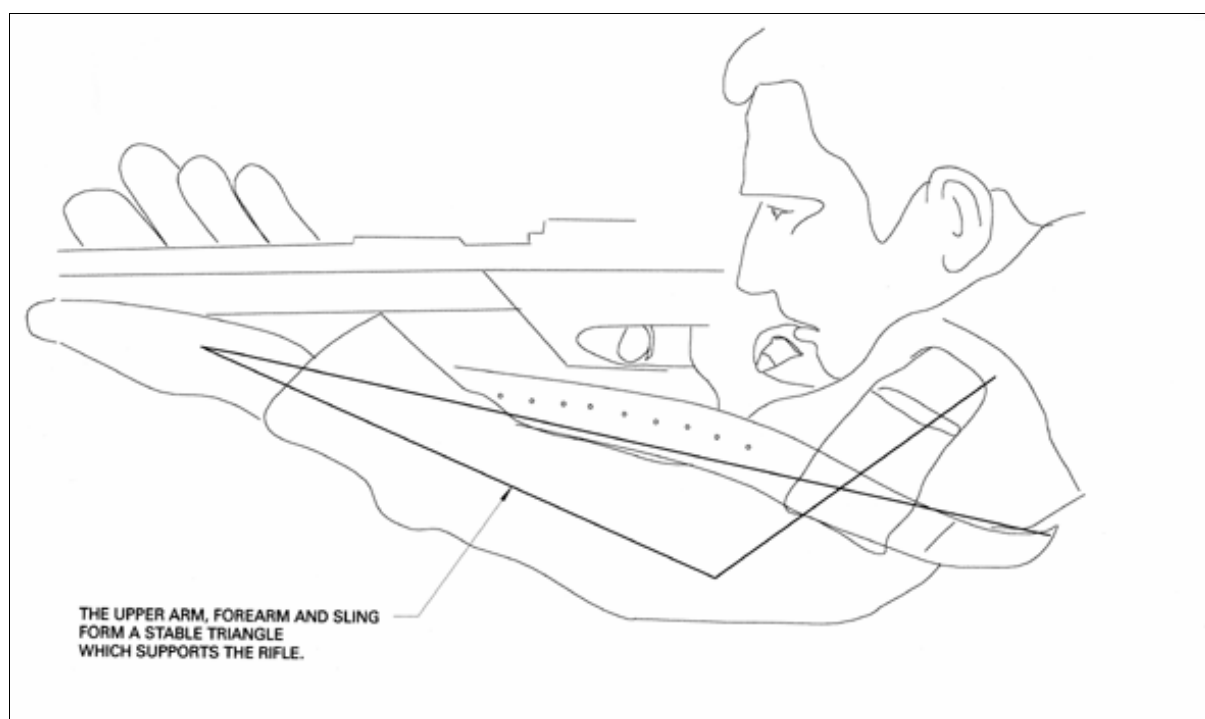
Bearing in mind that it's totally impossible to keep a live human body perfectly still (there is always a pulse and some muscular tension) and given that a considerable amount of muscular tension and strain is required to hold a rifle on a target, if you're shooting in the prone position, most of this is taken by the left arm (if you're right-handed).

The problem with relying purely on muscle power to hold something steady is that there will always be a tremor, which is shown up by the sights - in fact nowadays the sighting systems are so precise that they appear to magnify every little pulse movement - so if this could be removed then it would be much easier to achieve the consistency required.

The sling, therefore, offers a means of holding the rifle with as little muscular tension as possible: by supporting the weight of the rifle, it relieves some of the strain from the left arm and lifts the tension from the muscles.

The obvious question here is “if it takes so much strain to hold a rifle steady, why don't we just use lighter rifles?” The main reason for using a heavy rifle is that the sheer weight of the rifle helps to dampen out the movements caused by body tremors, but you can only go so far in that direction before the weight becomes a disadvantage, so the modern target rifle is a compromise between being heavy enough to dampen the vibrations and light enough to be manageable.

Therefore, if the sling is to do its job properly, it must bear the weight of the rifle so that the supporting arm can be as relaxed as possible.



The sling is for support without effort

(Many people seem to think the sling should be an item of torture, being so tight as to make both your arm and your hand go dead. Although it is perfectly possible to shoot quite well with a totally dead arm, that's not the purpose of a sling - it is not a tourniquet!)

The sling should pull from the back of the arm *only*, and should be as high up as possible so that it's above the muscles in the upper arm. In order to ensure that the sling only pulls from the rear of the arm, it must be adjusted so that there is room to get several fingers between the front of the sling and the arm itself; therefore, don't adjust it too tightly - when it's not actually supporting the rifle it should be fairly loose on the arm.



Room between the front of the arm and the sling

The reason for this is that, when you get into the shooting position the pull on the sling will mean that all the muscles, tendons and arteries etc. will simply be eased around to the front of the arm, into the gap left by the loose sling, rather than being crushed against the bone which would create a heavy pulse beat which will be transmitted to the rifle.

However, if the sling is going to be loose on the arm, when you need some reliable means of ensuring that (a) it's always in the right place when you get down to shoot, and (b) it stays in that place while you're actually shooting.

This is where you need a correctly-fitting shooting jacket with a sling loop attached to the shoulder, which then holds the sling in position at the top of the arm. However, this only works if the jacket fits properly, otherwise the weight of the rifle pulls the sleeve down the arm while you're shooting, which leads to a sinking feeling and increased muscular tension as you try to hold the rifle up on the target.



The sling loop attached to the shoulder keeps the sling up

There are all sorts of different slings on the market, and there are a number of things to bear in mind when contemplating a purchase.

The sling should not stretch under any circumstances, so a plastic sling with a web of non-stretch canvas embedded inside may be favourite - that's not to say that leather slings are out of the question, it's just that leather does stretch and it's very difficult to guarantee that it won't do it while you're shooting.

The next thing to examine are the various buckles and clamps attached to the sling; they must be substantial because of the considerable force exerted on the sling, and fittings must be well stitched or rivetted together, so look for any point which could be weak, remembering that a chain is only as strong as its weakest link.

Many slings have rubber, neoprene, or similar material stitched to the inside where they go round the back of the upper arm. This helps to stop the sling from slipping, as well as easing some of the pressure on the arm, so this is certainly worth considering.

Adjustment of the sling must be easy - it may not be something you do every day, but if you find yourself on a strange firing point unable to get comfortable, then it should be a simple operation to let out your sling a notch when you need to.

You can buy a piece of kit that attaches to the sling and allows you to make very small adjustments to the tension of the sling, to enable you to make up for uneven firing points and targets being higher or lower on different ranges.

It's also a good idea to have some sort of clamp attachment which sits just in front of the upper arm and clamps the sling together immovably, as any 'give' at this point would effectively lengthen the sling during your shoot. Some manufacturers incorporate a convenient aluminium clamp, others use removable screws; it doesn't matter what the system is so long as it's effective. However, anything which has a self-tightening cuff should be avoided, as the action of pulling on the sling creates a squeezing effect on the upper arm, resulting in a distracting and often painful pulse. The sling should also be curved, as a straight sling would tend to dig its upper edge into the back of your arm, and any adjustment buckles should be on the inside of the sling, i.e. between the arm and rifle, to enable adjustments to be made without having to move too far from the shooting position.

From this you'll guess that left-handed shooters need different slings to right-handed shooters, but most manufacturers do produce both versions.

There is a great combination of forces working on the sling: obviously there is the weight of the rifle, but added to that is the weight of your shoulder pushing against the butt, so the success of the resulting position is all about these forces being in balance, which depends on a number of factors.

First of all, think of the forearm, upper arm and sling as forming the sides of a triangle with its apex downwards; on the face of it this is a fairly unstable physical arrangement, except that you have a large body (!) attached to one corner, which comfortably counteracts any weight added to the other end of the sling.

If the triangle is tall and thin, i.e. with a short sling, then two things happen: firstly the position is unstable and wobbly, and secondly it plays havoc with the elbows. Lengthening the sling opens out the elbows, giving more bearing area, lowering the position and stabilising it. Be careful, however, not to break the '30-degree' rule which states that the forearm must form an angle of at least 30 degrees to the horizontal - remember that the Range Officers (bless them) at Bisley are equipped with devices to measure this from a distance.

So, to counteract this tendency to lower the forearm, you should move the elbow forward so that the shoulder drops and you tend to lay on the back or upper part of the elbow, rather than right on its point.

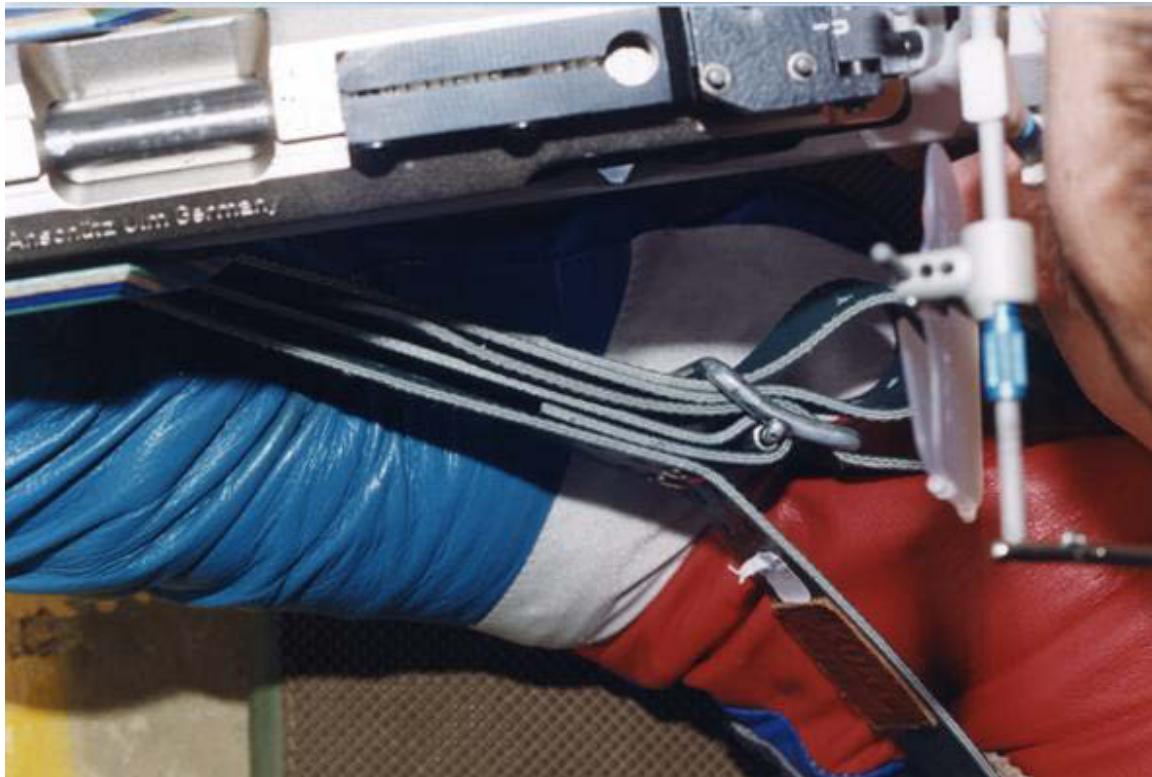


Elbow forward gives a low position

It is of paramount importance that the wrist of the supporting hand is kept straight, as any tendency to bending caused by a sling which is too tight can have an excruciatingly painful effect. A straight wrist will support much more weight than a bent one, so while a sling should be tight enough to support the rifle, it should not be so tight as to bend or force the wrist into an unnatural position.

The position of the elbow relative to the rifle is also important; while there is no absolutely exact position because this varies with body size and weight, the extremes can be defined.

In plan view, it's unwise to have the elbow outside the sling because of the tendency to lean against the rifle. At the other extreme it would also be unwise to have the elbow too far under the rifle, as this tends to create a rather springy hold, causing the rifle to want to fall to the left (or to the right if you're left-handed).



The point of the elbow under the sling or slightly inside.

It's also risky to get the elbow too near to the rifle, in case you accidentally break the rules and actually allow your rifle to touch any part of your jacket other than at the shoulder.

So, the correct place for the elbow is where your whole position is in balance without strain, and the rifle is resting naturally on the target.

There are a variety of different ways of actually hooking your sling up to the rifle in preparation for shooting and it would be impossible to define the best way of doing it, other than saying that the method which requires the least effort has to be the favourite.

One way is to lay full length on your mat on your left side (if right-handed), hook onto the rifle, then roll over onto your stomach and lift the rifle butt up into your shoulder.

Another way is to get all hooked up while still kneeling on the mat, then place the elbow on the ground in the right place and lower the rest of the body onto the mat. A word of warning with this method: make sure you don't shuffle down inside your shooting jacket like a tortoise inside its shell. That can cause a lot of jacket material to end up around the back of your neck.

After hooking up to the rifle it's important to check the way the sling lays around the arm and make sure that it's in the correct place. If the sling is laying against a fold in your jacket sleeve, it could move while you're shooting, effectively altering the length of the sling.

Or you may have your sling around both the glove and the jacket cuff on one card, but for the next card the cuff may have moved out of the way, giving a different sling tension, so it's important to check these small details, as they can explain why one card is often better than another.

In conclusion, remember that the sling is an essential and important item of your equipment - don't neglect it, treat it with respect and if your sling looks old and tired, consider replacing it with a new one; it may take some time to get used to, but it could work wonders for your scores.

THE 'LOCATING-YOUR-HAND-IN-THE-SAME-POSITION-EACH-TIME' SHOOTING AID

One of the most misnamed pieces of equipment currently being attached to smallbore target rifles is the so-called 'handstop' - that lump of metal against which a large number of shooters ram their hand in an effort to inflict as much pain on themselves as possible, so that they can't be accused of enjoying their shooting.

However, it's difficult to decide what else to call it, so it will continue to be referred to as a handstop, although its exact function is somewhat different.

First of all, it is *not* intended to *stop* your hand going anywhere; with your hand in a shooting glove, wedged up against the underside of your rifle, held in place by the sling across the back of your hand, the weight and small amount of recoil of a .22 rifle is not going to cause your hand to go very far, so why do you need a handstop?

Seemingly, the answer is to ensure that your hand is placed in exactly the same position each time you get down to shoot; that could, of course, be achieved by ensuring that the sling attaches to the rifle in exactly the same place every time, i.e. by just using a sling swivel fixed to the rifle's forend, and although some people do in fact shoot like that, many shooters find it uncomfortable.

So, it's not actually necessary to throw away your handstop (although it probably wouldn't make any difference to your scores if you did) - but you should certainly take a great deal of care when selecting the type of handstop to use.



A selection of handstops

Shooting should be undertaken in as comfortable conditions as possible and, while absolute beginners may find the whole shooting position very uncomfortable, it does get easier as you go along and begin to refine your position. Anyone who's been shooting for some years has no excuse for being uncomfortable (or in pain even!).

Rifle shooting in *any* position is not the most natural of pursuits, but whatever you can do to make it *more* natural will also make it more comfortable, and if you're comfortable you'll be able to concentrate on what you're doing, and should shoot better as a result.

Here's an exercise: hold out your left hand in front of you (right hand for left-handed shooters) in a relaxed state with the palm upwards, as though you were waiting for someone to hand you something.

If you look carefully at your hand you'll probably find that the fingers are curled up slightly, the wrist is straight (not twisted or bent back) and your palm is probably slightly curved upwards; take particular note of how the thumb is laying close to the side of your palm.

There will, of course, be small differences in individuals, but generally the gap between your thumb and the side of your hand will only be a matter of an inch or so when your hand is completely relaxed.

Next, feel the area of the web between your thumb and the knuckle of your first finger - that area is quite soft, but it's also quite small and that's where you want the handstop to fit.

If there's any risk that your handstop is too big to fit into that small area of your hand, then it will probably bear on the first knuckle and that can bring excruciating pain during a shoot. How many people have you seen getting up from the firing point, massaging and shaking their hand? That can be a sign that something is wrong with the hand-to-handstop relationship.



A totally unsuitable handstop because it's too wide

If your hand is held totally still, wedged into a small space for 20 minutes it may need some assistance to get the circulation going again, but that should not involve pain or total lack of feeling.

Therefore, you should go for a handstop which fits into the web of the hand comfortably; you can easily experiment with round objects around the home to see what size fits most comfortably into the gap between your thumb and hand, without bearing on the knuckle and without digging painfully into the web.

You'll be surprised how small a diameter you need; the average hand probably only needs something about 30mm, which is roughly the size of a gin bottle top. Anything

larger and it may start bearing on the knuckle, which you don't want.

So, if you are using a round handstop, that's how to settle on the size you need; if you're using a shaped one, then you must ensure that it doesn't force your hand and thumb apart.

There is something else which has some influence on the size and shape of handstop, and that's the tension of your sling. It's very important to remember the exact function of the sling - it's there to support the weight of the rifle and relieve the muscle tension which would result from you trying to hold the rifle up on aim.

Too many people strive for a tight position and pull their sling up too tight, which tends to pull the palm of the hand back towards the body and bend the wrist.

This can lead to the worst kind of pain imaginable, as the strain on the wrist ligaments can be enormous - remember that your wrist is made up of lots of little bones which don't take too kindly to being forced into unnatural positions.

(OK you can put your outstretched palm down now!)

Next time you're sitting at a table or desk, just extend your elbow out onto the table top in as natural a way as you can, palm uppermost, so that there's no strain or pull on the wrist.

You will probably find that your wrist is fairly straight and the hand slightly curled as before; this is how your wrist should look when you're shooting.

Keeping the elbow resting on the table, raise your forearm to an angle of just over 30 degrees (to comply with U.I.T. rules) then it follows that, with a straight wrist your hand must also be at the same angle, so if you shoot with a rifle with a flat underside to its forend, then you must cant the rifle towards you to enable it to fit naturally and comfortably in your hand without you bending your wrist.

If you have a rounded forend to your rifle, it's not quite so important to cant, as this shape is more likely to fit the contour of your upturned palm; however, the more you can get the weight of the rifle over your wrist the more stable it will become, and canting the rifle inwards helps you achieve this.

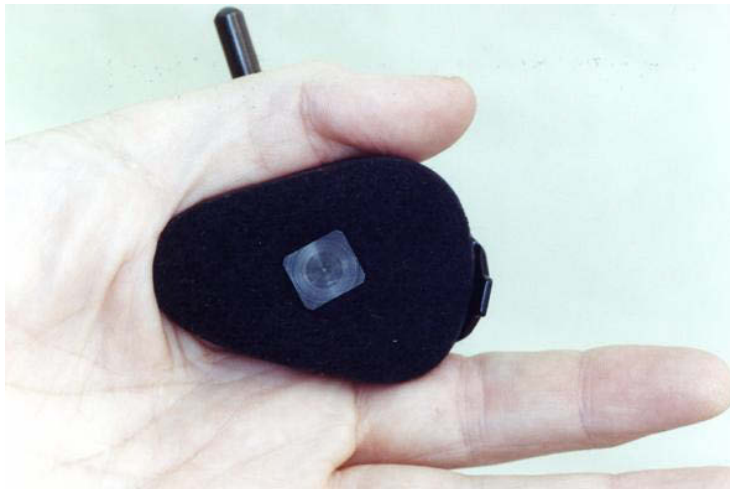
If you still have your arm stretched out over the table, try holding the back of your hand parallel to the table top - this will probably involve bending the wrist back slightly.

Now press down on your outstretched palm with your other hand - you should notice that your wrist has lost some of its rigidity; if you then straighten your wrist you'll notice how much firmer it has become.

Next time you're down on the range with your kit, get into position without your glove on and take note of how your hand and wrist lie, naturally or bent.

You may wonder why there is any need to worry about rigidity and weight when the sling is taking the weight of the rifle, but the point is that it is an over-simplification to say that the sling takes the weight of the rifle. What it actually does is form one side of a forces triangle, where the rifle's weight is carried by your forearm and the sling, and the combination should balance such that there is no muscular strain on the arm supporting the rifle.

The previous photo shows a handstop that is too big for the average shooter because it is too wide (approximately 50mm where it fits into the web of your hand) and encourages you to spread your hand out and twist it, while bearing on the knuckle bone. (This particular style of handstop is rather dying out now and, is not readily available on the accessory market, although it does turn up on old secondhand rifles.)



This handstop fits well into the web between thumb and forefinger

Some handstops can appear to be quite wide at first glance, especially the anatomical ones, but the important part is the bit that goes into the web between your thumb and first finger. You will probably find that at that narrower end, if it's not much more than 30mm or so, then it will fit quite comfortably into your hand.

It is too late when you've put your new handstop on your rifle, only to find that it's too painful to use, so you need to examine it closely and try it carefully in the hand.

All the rifle manufacturers have their own ideas about what constitutes a good handstop because that's what *they* fit on their rifles. That doesn't mean you have to accept their ideas and you can soon change a handstop if it is giving you any pain with your hand in the right position.

As a last resort if you find the handstop too big you could always take a file to it and trim it down until it is comfortable, better that than a pain that will influence your concentration.

Don't make it too small - if you end up with a relatively sharp edge like the bow of a ship, you could find that it's painful in the shooting position because it digs into your hand.

Time spent getting this right will pay dividends later by ensuring you are comfortable and in a natural position.

CHAPTER 8 SPOTTING SCOPES

There's an old adage often repeated in the shooting world that, "if you can't see it, you can't hit it". This refers to your sight picture generally, but there is another form of 'seeing' which plays a very important part in every rifleman's life, and that's being able to see where the shot went.

Sighting in (or zeroing in, whichever you prefer to call it), is vitally important but that's impossible to do properly if you can't see where your shots are going.

Imagine what it would be like if you were aiming at one 25 yards diagram and were using a new rearsight. If your first shot misses the card completely, how would you know (short of inspired guesswork) where to point your rifle in order to get the next shot on the target? That's what shooting without a scope is like.

Luckily the rules allow the use of sighting diagrams to get your rifle zeroed in *before* you start on a competition card, but think what the scores might be like if you weren't allowed those sighters, particularly at 100 yards.

All this sighting relies heavily on you being able to see where your shots are going, and although that may seem terribly obvious, how *well* you can see is also important.

Spotting scopes are usually bought as an extra to the rifle and it's amazing how little attention people pay to their scopes, ending up with all sorts of rubbish.



Straight and angle eyepiece spotting scopes

So many shooters make do with anything which allows them to see the target and then complain bitterly when they get caught out on a strange range with the sun in the wrong direction by not being able to spot their shots

Another old saying is “you get what you pay for” and, of course, spotting scopes are no exception to this rule. There has to be some reason for one spotting scope being twice the price of another - or even three or four times the price - but it’s quite possible that you don’t always need all that extra quality.

If this is starting to sound confusing and contradictory, then read on!

The largest market for spotting scopes in this country is for the bird watchers and they demand a considerably higher quality in their scopes than the average shooter. One reason for this is that bird watchers must have their lenses colour-corrected, whereas shooters generally shoot in black and white and have no worries about any colour discrepancies which may occur.



A typical good-quality spotting scope

The size of your pocket, or more importantly, what’s in your pocket, will help you decide on a scope to some extent, but here are a few points to look out for.

There is a relationship between magnification and the size of the object lens (the end nearest the target), and that relationship affects the amount of light which reaches the eye. As the magnification increases, so the light reaching your eye decreases.

Most spotting scopes used in shooting are in the range of 20x to 30x magnification and that’s usually marked on eyepiece lens. This sort of size will general cope with all types of smallbore and fullbore rifle shooting.

Some manufacturers produce a 'zoom' eyepiece covering magnifications from 20x to 60x. Although you may occasionally find this variability useful, the number of lenses involved in a zoom eyepiece means that the amount of light reaching your eye is reduced somewhat (approximately 3% per lens face) which doesn't do a lot for your sight picture.



A zoom eyepiece lens maybe useful

The other element in the equation, is the size of the object lens, and this is usually referred to by its diameter in millimetres. For example, if you have something which is described as a 22 x 60, then the magnification is 22 times, and the object lens is 60mm in diameter.

It's recommended for all normal smallbore target shooting that you don't use a scope with an object lens of less than 60mm, for the simple reason that you'll find the picture too dark should you get caught in bad weather (and who hasn't been caught under dark thunder clouds at some time or other?) Even indoors, although the range is much shorter, the light is also much less bright than outdoors and, while you may think you can see the shot holes, you could be straining your eyes to spot a shot if the picture isn't clear enough.

The question of which magnification to use is personal, although the range is limited anyway. It's not recommended that you use less than 20x magnification, and more than 30x brings other problems.

There is a formula for the increase in loss of light through a scope as the magnification goes up, but that is beyond the scope of this book.

The fact that there is a loss of light that results from increasing the magnification is sufficient for the rifleman to be wary. To what extent it would affect you, only you can tell, but bear in mind that doubling the magnification means that the amount of light reaching your eye goes down to 25% of what it was, assuming the object lens diameter stays the same.

If magnification - and lots of it - is your goal in life then as you go up in power you will need to increase the diameter of the object lens. Nothing is absolutely straightforward and "getting what you pay for" could lead you astray at this point. The higher the magnification the more critical the optics become; in other words a cheap high power may *not* improve your vision over a better quality low power within the ranges mentioned above.

Another factor is eye relief: as the magnification goes up, so the eye relief goes down and that means having to get your eye closer to the scope.

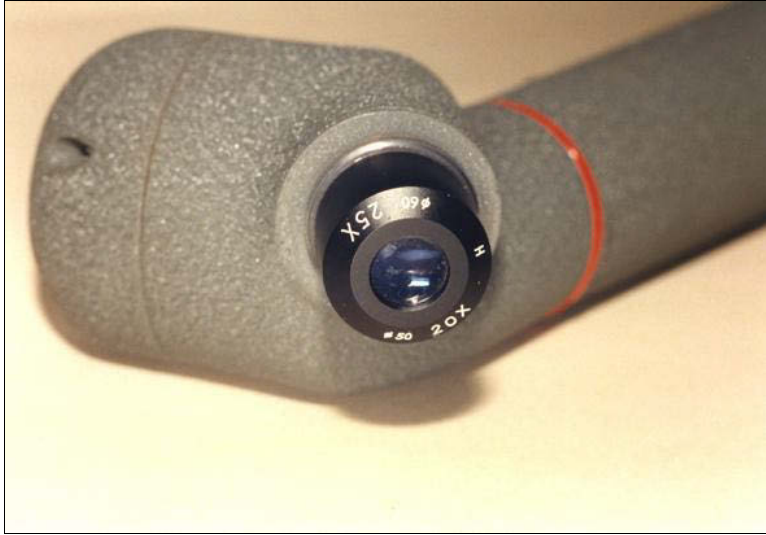
The smaller the eye relief, the more critical the scope position is in relation to your eye and the last thing you want to be doing is straining to see through the scope while you're shooting. Those of you who gradually change your position while you're going round a card could find yourselves having to move your head too far in order to see through the scope, which could result in considerable discomfort and could adversely affect your position.

With a nice long eye relief, it only takes a quick glance through the scope to tell you everything you want to know about your last shot.

You should find that your scope's optics are so good that you can see what's happening quite clearly, even if the aiming mark is right on the edge of the lens. With a good scope the eye position is not quite so critical and you consequently shoot with a very long eye relief, which enables you to fill the eyepiece lens with whatever aiming mark you're shooting on at the time, without any great head movement.

It's a bit difficult indoors because you really do need to see the whole card, and it becomes a struggle to get a 25-yard card and sighter in view; with a magnification greater than 25x you would probably have to move the scope during the course of your shoot.

Most scope manufacturers give you a choice of eyepiece lenses, and some even give you the extra options of high resolution and wide angle. I know Kowa offer H.R. or W.A. and their 25x H.R. eyepiece is excellent; in poor light particularly, you can really see the difference the high resolution makes.



A 25x high resolution eyepiece with 60mm objective lens

A new spotting scope is not something you will buy very often and one of the problems is that they do deteriorate with age. Unfortunately the deterioration is slow and most shooters don't realise, until they look through somebody else's scope, that their own has got so bad.

The thing which goes first is the edge definition and that can go unnoticed by a lot of shooters because they spend most of their time looking at the centre of the lens. If that's the case, why should you need to worry about it? The answer comes back to eye relief - if only the centre is sharply defined, the position of your eye is much more critical if you want to get a clear picture

If you're considering buying a secondhand scope, then the edge definition is the first thing to check. It's no good just looking through the lens at the first thing you come to and assuming it's OK because you can see what you're looking at. You need to rest the scope on a firm surface and look at something small some distance away, preferably in daylight. Focus on something like a sign or a notice about 25 yards away and then move the scope so that the object is right at the edge of the lens. Can you still read the wording as clearly as you could when it was in the centre?

Beware of a secondhand scope that looks as if it's been taken apart (damaged screws and misaligned joints could indicate this); some people have been forced to buy a new scope because they took their old one apart and couldn't get it back together properly. It would also be a good idea to avoid something which looks as if it's suffered a bad knock, or has been dropped, as this tends to loosen the prisms inside, or even crack them.

One of the most common spotting scopes on the market is the *Greenkat*. These may have different names on them, such as *Opticron* or *Rhino*, but they are basically the

same scope. They have been around for a long time and have given sterling service to lots of shooters, but beware if you're in the secondhand market: neglect and age do take their toll on scopes such as these.

These days they retail (new) for around £130-£150 and, considering how many years they last, that does represent value for money. Their usual configuration is 22 x 60, but 30x eyepieces are also available.

A typical *Kowa* scope will certainly cost you twice as much as, if not more than, the *Greenkat* but they can be well worth the extra.

There are other scopes on the market but it would be difficult to go through them all, so to help with any decisions you might be taking about making a purchase, do bear in mind the following points:

You get what you pay for, but you *may* not need all that quality.

Don't deviate from the standard size of 20x to 30x with a 60mm object lens. That's not to say that bigger is not better, it's just that bigger could get more expensive without any major benefit.

Do try and choose a scope that has the focussing adjustment right at the back, somewhere near (or on) the eyepiece; if you do have to make any adjustments when in position it's much easier if the knobs are close at hand. Beware of scopes which have a focussing ring half way down the body, as that may be where you have it clamped in your stand, or you may have it protected by a cover, making it impossible to get at.

Some scopes have a threaded boss which allows them to be mounted on a camera tripod - you'll have to decide on the value of that for yourself, as extra 'legs' can get in the way when you're shooting prone.

There is also one other major consideration which has been left till last, i.e. whether you should go for a straight eyepiece or an angled one. Most shooters find that an angled one is better because it gets the scope body down below your line of sight, allowing you to see any wind flags to your left (or to your right if you're left-handed). In addition, it physically requires less movement of the head when looking through it.

But (and there's always a 'but') angled scopes can be more expensive and they're not so easy to use at first. Some even have revolving prism heads so the eyepiece has more angular movement. However, straight eyepiece scopes are gradually dying out, so you may not have any choice in the matter, particularly if you're buying new.

Whatever type of scope you buy if you want to get the best service out of it get a cover to protect it, keep the lenses clean and use the lens caps to prevent scratching.

Having now got your scope, you need to get it into the right position and find out how to use it. (Before anybody turns the page muttering how obvious and easy that is, let me assure you that nothing in rifle shooting is as easy as it first looks.)

Before you can use your scope properly, it needs to be positioned in exactly the right place. There's no point in carefully aligning yourself with the target and getting both yourself and the rifle comfortable, if you're then going to crawl across the mat and get up on your hands and knees to look through the scope. That may sound terribly obvious, but some people very nearly do just that on the firing point.

Placing the scope in just the right position reduces movement between shots to the minimum, and can reduce the possibility of getting out of position, which *might* happen if you have to keep moving to see through the scope.

Modern scope stands all tend to be of the two-legged variety, and modern materials and manufacturing processes have produced some marvels of engineering which present the scope to your eye while staying well clear of your body.

A quick glance at some of the photographs within these pages will show you what's currently available.



A collection of scope stands

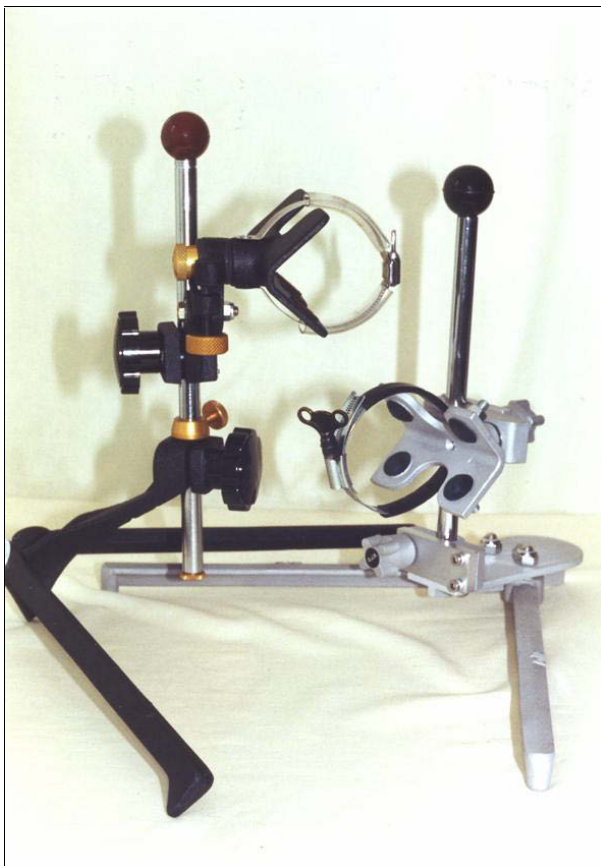
A very early decision which needs to be made is whether you will ever be shooting the 3-positional discipline in the near future. The most basic scope stand cannot be extended to cover the kneeling and standing positions, but as one of the longest-serving stands, which has supported countless varieties of scopes for thousands of shooters, it will be the first choice for lots of people.

First of all, a good stand must be rigid when in use; a shaky scope is impossible to look through, so you don't want one that will move in a wind, for example. Also, a scope should be able to resist those little knocks and taps that happen while you're getting into position, as the last thing you want is for the scope to move off target before you've even fired your first shot.

Secondly, there should be plenty of room for your left (or right) elbow under the scope, without you getting anywhere near the stand. This usually rules out tripods, as using one of the modern, short-bodied scopes means that one leg of the tripod nearly always gets in the way of an elbow.

Generally, modern scope stands provide 15cms-25cms of cantilever, which is enough for most people to get the scope really close to their eye, without fear of interfering with any part of the arm.

Thirdly, the stand should be light, but heavy enough to be stable, and should fold up fairly small.



Two more scope stands

The actual connection of the scope to the stand is not too important - providing it's secure. Once having fixed it to the stand and got it in the right position, you're unlikely to be constantly taking it in and out of its fixing (stretch-over springs, or a jubilee clip are favourites).

Look for nice big easy-to-use knobs which hold component parts together without any undue force. Small, stiff-to-turn, slippery plastic knobs can make life very difficult on cold ranges, with fingers one stage away from terminal frostbite. A large plastic round knob on top of the vertical rod also makes carrying very easy once the stand is assembled.



Big knobs help!

So, once you've got a decent scope and stand, what do you do with them?

Usually this combination is the second thing placed on the firing point after the mat which, as most shooters know, is carefully aligned with the target so that you can place the scope stand down relative to it. Some shooters even mark the edge of their mat to show where the scope legs should go.

Getting the scope in the right position relative to the eye for the first time will probably necessitate you enlisting the help of someone who can adjust it for you while you're in the shooting position. Once you've got this sorted out, however, you should be able to assemble it in the same position each time fairly easily.

The eye relief on scopes can vary considerably, so you'll have to experiment with the best position for *you*, but try to keep head movement down to the absolute minimum.

Some people don't bother spotting every shot once they've sighted in, but this requires both courage *and* the knowledge that you're not making any mistakes which might need correcting. Shooting without spotting your shots can be extremely good training, but it's not something to be recommended for competition work.

Scope stands require very little maintenance, apart from the odd nut or bolt coming loose, or springs stretching, but as most of them are actually manufactured in Great Britain, there should be no problem with spares.

One last word of advice - do spend time getting your scope and stand in just the right place; if you make any slight alterations to your sling or handstop, you may have to alter the scope height slightly as well. Quick and easy spotting of shots is essential - don't strain anything trying to see where the last shot went, as it could cause your sight picture to deteriorate, or it may make you lose your position.



Get that scope close to your eye!

CHAPTER 9

TELESCOPIC SIGHTS

Ever since the gun was first developed back in the 12th Century, the shooting world has had its fair share of stories about the prowess of various marksmen.

Shooters, a bit like anglers, take great delight in telling people (usually other shooters) about how they once hit a target so far away and so small, and moving so fast, that it would seem that the feat was impossible.

Target shooters - and in particular smallbore target rifle shooters - tend to be a more modest bunch and are more likely to tell you about their mistakes rather than how brilliantly they've shot.

All that's about to change! This story concerns someone shooting at 50 metres when a fly decided to take an unhealthy interest in the targets while he was sighting in. It wandered about, occasionally disappearing when it went onto a black aiming mark, then reappearing somewhere else, totally oblivious to the 40 grains of lead bullet whistling past its head at over 600 miles per hour.

It seemed to have no inclination to depart and there was obviously no point in shouting at it, so the shooter decided to take a shot at it. With that, the fly was no longer visible, but it wasn't until the shooter walked down to collect his card that he could see parts of the fly sticking to the edge of the bullet hole.

How do you shoot a fly at 50 metres with one shot? With a telescopic sight, of course. However, this isn't the main reason for buying a telescopic sight and, in case you're wondering why shooters spend so much money on telescopic sights, the main reason is the considerable number of benefits which can be gained from using one.

Firstly, a telescopic sight can be used as an aid to training; it will tell you things about your shooting that you didn't know, or hadn't seen. You can actually see quite clearly if you have a tendency to snatch at the trigger, or tense your arm, or drift to one side or the other as you release your shot, and once you can identify a particular fault then you can concentrate on doing something about it.

Secondly, it's good fun. You can't use a telescopic sight for normal leagues or most open shoots, of course, but there are a number of 'any sights' competitions around where scopes may be used if wished.

If you speak to most people who shoot with a telescopic sight they will probably tell you that they do it because it's different and because, somehow, there's not the same amount of pressure as there is with normal league cards.

Of course, a competition card is still a competition card, but it's like a coarse angler going sea fishing, or a snooker player having a game of pool - it's the same sport but in another dimension, not too far removed from the main interest.

However, before going too deeply into the benefits of a telescopic sight, let's have a look at what they are and what features are needed to make the best use of one.

Firstly, as this is a target sport, there is a fairly rigid definition of what type of sights can be used, in order to make sure that no-one has an unfair advantage.

So, in normal competitions shot under NSRA rules, you'll find that you're allowed a lens of up to 1.5 times magnification in the back sight, and the rules changed in 2003 to permit a small amount of magnification in the foresight (currently 0.5x is the largest magnification available).

Most leagues, competitions, etc. in Great Britain are run under these rules (UIT rules are even more stringent when it comes to what type of sights you're allowed to use), but the NSRA does run an 'any sights' postal league, as well as individual competitions at the national meetings.

In addition, various regional organisations and open shoots often have leagues or competitions when telescopic sights may be used.

The terms 'any sights' means exactly what it says, so you can use your ordinary everyday sights, or you can clamp onto your rifle a great long tube containing optics good enough to enable you to shoot flies at 50 metres (N.B. this is *not* an official NSRA target!)

The normal magnification for a telescopic sight can range from 16x to 24x; there are bigger and there are smaller, but outside these limits you tend to run into other problems.



A typical receiver-mounted scope

Telescopic sights of the type normally used by smallbore target rifle shooters are more akin to the sort of sights used by the 'bench rest' riflemen, rather than the rabbit or deer shooters. That means they can be very powerful because smallbore shooters hold their rifles so steadily (!), whereas a vermin or game shooter is unlikely to use anything more powerful than 10x magnification, and a 'bench rest' shooter may go up to 36x or possibly even more.

The first thing you'll notice on looking through one of these high magnification scopes is how big the target is. If it magnifies 24 times, then it looks as though the target is only $1/24^{\text{th}}$ of the distance away, so at 50 metres it appears to be the size it would be if it was only approximately 2 metres away. Similarly, at 100 yards the target appears to be only 4 yards away, or thereabouts.

How could you possibly miss?

For those of you who can see your pulse beat through your normal aperture sights, the bad news is that *that* will be magnified 24 times as well, so what you originally thought was just a tremor now becomes an earthquake. This affects some people to such an extent that they are afraid to pull the trigger, because the crosshairs are bouncing around so much.

Don't worry about it, it's purely psychological; your pulse beat hasn't changed just because you've fitted different sights to your rifle (although there is a slight difference in weight, which I'll come to later). What you see is what you always shoot with, so there's no need to panic, just get on with it.

Before getting into how to shoot with a scope, let's have a quick look at the different types which are available - not a great selection, unfortunately, as they're all manufactured overseas, and there isn't a particularly large market for them.

Firstly, one of the most famous of the telescopic sights used around the ranges for .22 rimfire is the *Redfield 3200*. Your first impression may be that it's a very long scope and, at 23½ inches, you're not mistaken, but if you're going to mount it half way down your barrel (where the mounting blocks are) then it's going to have to be fairly long.



The old Redfield 3200 scope: barrel-mounted

Of course, that's not the reason for the length of the scope, it's more to do with concentrating light paths from the target to your eye, especially as you don't need a large field of view with a target scope.

The *Redfield 3200* has its adjusting knobs mounted towards the back of the scope, otherwise it could be awkward to reach them, and they are $\frac{1}{4}$ minute click adjustments, i.e. approximately $\frac{1}{4}$ inch per click at 100 yards. That actually is a little on the coarse side, but with a scope it doesn't matter too much as it's so easy to aim off to compensate for any slight 'out of zero'.

The scope weighs quite a bit - approximately 1 kilo - which obviously has some effect on barrel vibrations, but certainly in most cases that's not a detrimental effect, (it may even be beneficial, but that's another story to be discussed later).

If the thought of all that weight bouncing up and down on your barrel bothers you, then *Redfield* thoughtfully also developed a shorter version, which is designed to be mounted on the rifle's receiver. They called this one the *6400* and it's very similar to its longer brother, as you can see in the photo.



The old Redfield 6400 scope: receiver mounted

These two scopes typify the basic differences between most types of scopes. Other 'long' ones which you might see around are *Unertl*, *Lyman* and some of the earlier *Tasco* models, which are all designed to be mounted on the barrel. The shorter ones, like the *6400*, *Leupold*, *Weaver* and newer *Tasco World Class* models are made to go onto the receiver.

It would be impossible to cover all the scopes that there are around but basically, having decided on the length, then the other specifications are similar and mostly down to personal preference, or what you can actually find. Many of the American scopes are no longer available new, but they do occasionally come up secondhand.

The number of clicks to the minute tends to be 4 or 8 - the latter being preferable if available, but it's not that important, and the crosshairs have to be very fine so that they don't mask the target.

Some scopes are available with crosshairs and a small black dot at their intersection, which some people find easier to use. It appears, on looking through the scope, as if the dot floats in the middle of the image, and because it's thicker than the crosshair, it's easier to see, so the eye naturally focuses on it.

It's only a very small dot - approximately $1/8^{\text{th}}$ minute in diameter - i.e. about half the diameter of a .22 bullet hole at 100 yards, so it doesn't mask the target.

The magnification of most of these scopes falls in the range 16x to 24x, which is not to say that other sizes can't be used, it's just that generally something between 16x and 24x seems to work best. The lower magnifications appear steadier, but the target is smaller, so it's down to personal preference once again.

Your scope must have some form of adjustment on the objective bell to allow for parallax variations, and in case you're wondering what *they* are.....

The lens in the front of your eye ball is flexible and, by muscular power, you can change its shape to allow your eye to focus on things close to you, or at any distance out to infinity.

Objects close to you, i.e. a matter of inches away, require considerable change in lens shape to focus on them, but as they get further from the eye, the change in shape necessary to bring them into focus is considerably reduced. However, the change necessary to focus on something 100 yards away and then something 100 miles away (infinity) is slight.

The problem with lenses in telescopes is that they aren't flexible and they rely on the automatic focussing of the human eye to compensate for any small out-of-focus element.

The higher the magnification of the scope, the further away its minimum focussing distance is, i.e. most of the high-powered telescopic sights we are

talking about can't focus to less than 20 yards. In fact some may not make the 25-yard range, but as we don't do much 25-yard scope shooting, that's not too important.

Generally a scope without parallax adjustment doesn't always focus the image from the object lens exactly on the plane of the eyepiece lens, but it relies on the human eye to compensate.

With adjustment in the object lens, the image can be moved the small amount necessary to bring everything precisely into focus.



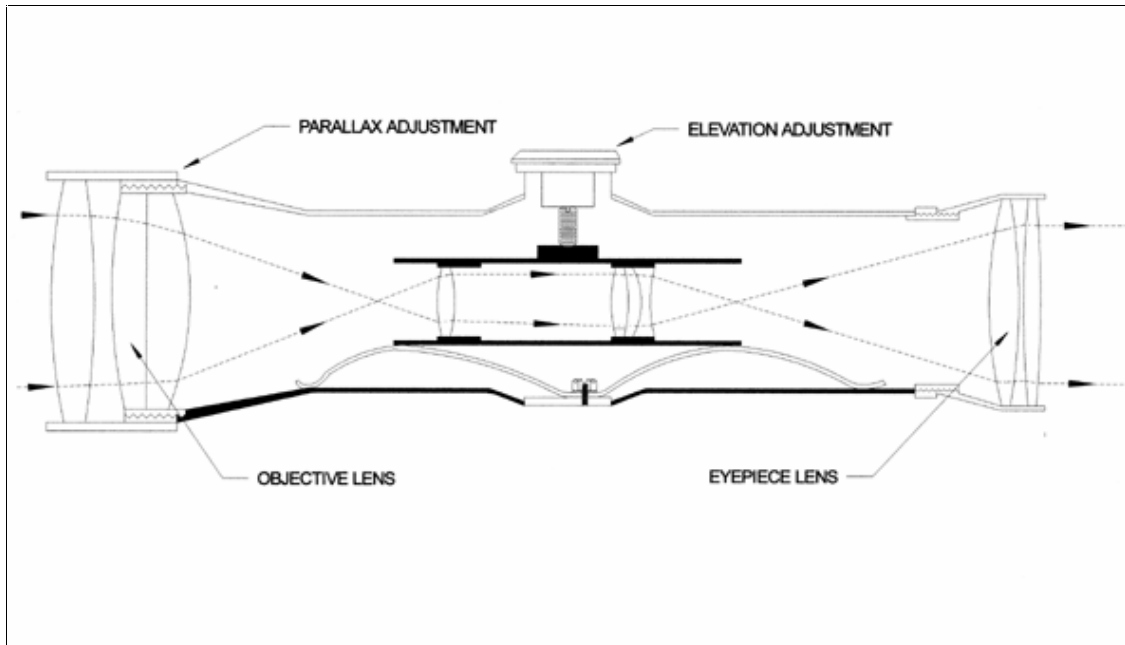
A variety of parallax adjustments

It is very critical that the crosshairs and the image of the target are on exactly the same plane within the scope, and the next part of this chapter deals with setting up the scope and shooting with it.

There's more to a telescopic sight than meets the eye!

If you've ever taken one apart - and this isn't to be undertaken lightly - you'll find that it isn't simply a matter of a bit of glass at the front end and a bit at the back, particularly in today's modern target scopes.

Looking at the sketch you'll see that there is indeed glass at the front and back, but this consists of groups of lenses, not all of which are the typical shape we associate with glass magnifying lenses.



The inside of a telescopic sight

The front objective group of lenses takes the light from the target, turns the image upside down, and focuses it on a group of lenses in the middle of the scope, which are housed in a moveable tube. These turn the images the right way up again before the light passes out through the eyepiece lens to the eye.

In high-powered target scopes the front objective lens needs to be adjustable to enable some very fine alterations to be made, to ensure that the crosshairs fixed inside the scope coincide exactly with the image, and are on the same plane. Scopes without that adjustment rely on the human eye compensating for anything which is slightly out of focus.

If the images of the target and the crosshairs are in different planes, a parallax error occurs, so that if you move your eye slightly, the crosshairs tend to move as well. (More of this later.)

The centre group of lenses is adjustable sideways and vertically to allow you elevation and windage movement. Most modern scopes are 'image moving' which means that when you wind up or down, you're actually moving this set of lenses, so that the crosshairs always remain fixed in the centre of the scope.

The eyepiece lens is also adjustable and usually has a locking ring at the front edge to ensure that it stays in place once you have 'tuned' it to suit your individual eyesight.

As you can see from the sketch, the light has lots of glass to travel through before it reaches your eye, and unfortunately this can lead to some of it being lost *en route*.

There will always be a reduction in light level as it passes from one medium to another, due to reflection at each surface, so manufacturers don't put any more lenses in their scopes than is absolutely necessary to do the job. They also go to enormous lengths to reduce the light loss as much as possible, by very carefully polishing the lenses and coating them with a non-reflective material.

Telescopic sights are also assembled under very strictly-controlled conditions to ensure that they remain fog-free in all temperatures. Scopes aren't intended to be taken apart by their owners, and I would recommend that you don't ever try unless you wish to destroy them forever.

Because they cannot be readily dismantled (which means that you can't get to the inside lenses to clean them) the manufacturers fill them with an inert gas (usually nitrogen) when they're assembled. The scope is then sealed so, no matter how much variation there is in the outside temperature, there's no moisture on the inside to condense on the lens where you can't get at it.

Most manufacturers test their scopes for gas leaks by the time-honoured method of chucking them in a bucket of water. The really top-class manufacturers actually create a vacuum above the water in a special tank, which encourages the nitrogen to try even harder to escape; no tell-tale bubbles in the water means that the scope won't leak gas out - or air in - and it also means, of course, that it's waterproof as well.

In some cases they even heat up the water, which causes the gas to expand and try even harder to escape; so, if you pay a lot of money for a scope, you really are getting your money's worth, and it's easy to see why expensive scopes are usually guaranteed for such a long time.

So, how do you set up a telescopic sight? It's not just a question of sticking it on the rifle and having a shoot - there are a number of things to get right before you can expect any sort of success.

The first and most important thing is how to mount it onto the rifle. If it's a long scope, it will need to be mounted onto the barrel; if it's a short one, it should go onto the receiver. It should *never* go half on the barrel and half on

the receiver as that will play havoc with the vibrations of a fully-floating target barrel.

The decision about exactly where it does go is dependent upon you and your position; what *is* critical is having the *correct* eye relief - here's one way of ensuring you get it right.

Get down on the firing point with your normal equipment, i.e. rifle with its iron sights in their normal place, and aim at a target. Now get someone to remove the sights without you moving your head any more than you can help, and substitute it with the scope, which your assistant should move backwards and forwards until you get the maximum amount of light through the eyepiece lens at the back.

This is the position in which your scope should be fixed, to ensure that you don't end up shooting with your head in a different position to normal.

The next problem is to find some mounts to fix the scope in the right place. If it's to be barrel-mounted, normal scope mounts attached to the mounting blocks on the barrel will suffice. If your barrel doesn't have such blocks, then it's a gunsmithing job to fix them, but it's well within the capabilities of a normal gunsmith, and your local gunshop should be able to help you there.

The receiver-mounted scopes are slightly more difficult to fix because their short length doesn't allow very much tolerance with backwards and forwards movement. Most target rifles, like the *Anschutz*, have a groove on the top of the receiver to accommodate their rearsights, and this same groove will accept most normal mounts.

If you don't have enough backwards or forwards movement with standard mounts, then look out for some offset ones. Having got your mounts onto the rifle, insert the scope, but before tightening down the clamping rings you'll need to twist the scope round to compensate for the cant you use.

Once again, lay in your normal shooting position with your levelling bubble in place, and ask your assistant to rotate the scope until the crosshairs are vertical; *now* you can tighten everything up. You may also have to make some adjustment to the cheekpiece on your stock if the scope is at a different height to your rearsight.

Putting the scope on and off the rifle is a simple matter of undoing the screws which clamp the mounts to the rifle and, if you make a small mark on the mounting blocks, you can ensure that the scope goes on in exactly the same place each time. You should then find that, as with your normal iron sights, there will be very little (if any) adjustment required to zero in, unless you're shooting at a different distance.

The next operation is to focus the eyepiece lens correctly. This can be done either on or off the rifle, and there are a couple of methods you can use.

The idea is to focus the lens on the crosshairs inside the scope; you may think that they *are* in focus, but it has to be done very precisely, and your eye is capable of making minute compensatory adjustments automatically, without you being aware of them.

Therefore, in order to be sure that you have the correct focus, look through the scope at something which is either totally out of focus, or something which is a long way away and has no form to which your eye will be attracted.

For example, you could use a plain white handkerchief draped over the front objective lens, or you could look at the sky, but whatever you use, your eye must not be capable of focussing on it. This way you'll know that when you look at the crosshairs, your eye isn't going to be distracted.

Now you have to make sure that you don't give your eye time to adjust its natural focus, so you must be quick.

At the first glance into the scope the crosshairs should be sharp and black; if they're not, your eye will re-focus within a second and the crosshairs will then *appear* to be in focus.

If you normally wear a shooting lens, you may continue to do so, or you may be able to adjust the scope to compensate for your eyesight, particularly if your only problem is lack of accommodation (see chapter 13 on eyesight).

Remember, though, if you suffer from a particular eye defect such as astigmatism, you may find that you see either the vertical or the horizontal crosshair more clearly than the other, in which case you should use your shooting lens as well.

If the crosshairs aren't sharp and in focus immediately, release the locking collar of the eyepiece lens and wind the lens in or out until they do become sharp at your first glance into the scope. Check this every so often during the season.

Don't think that because you set your scope up correctly 10 years ago, it will still be right now. Most people's eyes change over the years, so don't assume anything - your eyes will try to compensate for anything which is minutely out of focus, and that will make them tired, which will result in you struggling with your sight picture.

The next setting-up operation has to be done on the range, because you need some targets at 100 yards and 50 yards/metres. This adjustment will be made to the objective lens to remove any possibility of parallax error.

As mentioned earlier, the objective lens focuses the image inside the scope onto a group of lenses, which gives you the windage and elevation adjustments.

If the objective lens is not exactly in the right plane, that image could fall outside the lens and your eye would then accommodate that error, and re-focus accordingly. The problem then is that this doesn't coincide with your eye focussing on the crosshairs, and they go out of focus.

If you look at the target and it appears sharply in focus whereas the crosshairs don't, that's an indication that you need to adjust the objective lens. Most scopes have markings on the cases, but these are only a guide and aren't intended to be precise, so if you find that your scope reads '125 yards' when you're shooting at 100 yards, don't worry.

Remember to lock any locking rings securely; the main disasters can occur if you forget to lock the objective ring, or (even worse) forget to tighten the mounting clamps. It's better to check everything twice rather than shoot badly and then find that your scope falls off, just as you've finished.

To ensure that both the target and the crosshairs are in focus, they should both appear sharp and clear, but if you move your eye slightly to one side, each crosshair should stay exactly where it was; if one moves, then the image and crosshairs are not in the same plane and further adjustment is necessary, no matter how small.

If you've set the scope up properly as described, you'll *know* that the crosshairs are in focus even if they don't appear to be; generally the target will be in focus because your eye is drawn to the larger, more easily seen, object, rather than the fine crosshairs, and it's compensating for the error.

Now you have the scope all set up and clamped to your rifle and you're ready to rush down to the range and amaze yourself (and your friends) at your ability to shoot flies at 50 metres.

But just before you go, there is one other small job to do that may make life easier when you get on the range.

Set up the rifle on a table or similar, and remove the bolt or action so that you can see down the bore. Put the scope on and set the windage at about mid-range in its adjustment.

Now look down the inside of the barrel from behind the butt and line up the bore with something a long way away, but with a pronounced vertical edge (like the corner of a house somewhere down your road).

By alternating your eye between the bore and the scope you should be able to see that the crosshairs are aligned with the same object as the bore. This is called 'bore sighting' and is a quick and easy method of checking the alignment of the scope.

If the mounts are wildly out, for example, you should be able to see that, and possibly do something about it before you get down on the range.

If things line up OK, your first few shots will at least go on the target and it shouldn't be too much of a problem to zero in.

If things are not OK and you find that the bore is lined up with one house and the scope is with the one next door, further investigations will be necessary. Of course, there are adjustments on the scope, but they're intended to move a shot a matter of inches, not house-to-house distances.

The first things to suspect are the mounts. Have you got them both on the same way round? That sounds obvious, but it's amazing how many people can make such a simple mistake; they should also be a matching pair - don't ever use odd ones.

The next thing to try is turning the mounts around the other way - take them off the scope and clamp them on the other way round, i.e. so that the base clamping screws are on the other side.

If that doesn't work then, despite earlier comments, you'll have to try turning just one mount round. By this time you should be getting a feel for which way you need the scope to go to line up with the bore.

If none of the above works, then you're going to have to take a file to the dovetail on the underside of the mount, which is usually made of aluminium and therefore is relatively easy to modify. File out one side of the mount so that it moves over when clamped to the rifle.

If none of the above works, i.e. you still can't line up the scope on the same house as the bore, *now* is the time to visit a gunsmith and ask for help; either buy a new set of mounts or ask him to fix the existing ones.

If he can't sort the problem out, you may have ended up with a bent scope, and that's not a joke, but it does happen.

Now you're ready to start shooting, so choose your favourite ammo, pick a fairly still day and go out there and kill flies.

The first thing you'll notice when you get down on the mat is that your rifle is a lot heavier; you may need to make some small adjustment to your sling to help with the extra weight, but only do that if absolutely necessary, because it's much better to leave everything exactly as it is if you can.

Set up a card at 50 metres/yards. Whether you use your spotting scope as well is very much a personal preference - it's not necessary as you should be able to spot the shots accurately through your telescopic sight, but some people like to use their spotting scope to blank out their non-shooting eye.

A quick word here about shooting lenses: if you use a shooting lens you may need to continue to do so, but it's also possible that you can focus the scope without it, in which case the choice is yours.

Of course, if you have an eyesight error such as astigmatism then you'll still need to use your lens; if you don't normally use a lens and you find that one crosshair is much thicker or clearer than the other when you look through the scope, go and see an optician as you may be suffering from astigmatism.

Now you're laying on the mat with your rifle sitting comfortably in your shoulder all ready to start shooting; you open your eyes, look through the scope and - horror of horrors - the crosshairs are bouncing about all over the place.

Don't panic, this is quite normal; what you're seeing is the effect of your pulse beat magnified by the power of the scope. This pulse beat is always there when you shoot, but normally you can't see it, so what you now have to do is to accept it and shoot with it.

When you actually analyse how much the crosshairs move, it really isn't that much. With a 24x scope you should be able to hold it such that all the crosshairs do is just bounce around inside the bull. With smaller-power scopes everything will appear steadier and you may be able to hold to an apparently smaller deviation.

Zero in the scope by the method you usually use with your aperture sights, remembering that your scope may have coarser clicks, such as $\frac{1}{4}$ minute. After zeroing in at 50 metres and noting exactly where the parallax ring is, try the same thing at 100 yards.

Re-focus the parallax ring so that both the target and the crosshairs are sharply in focus and note the position of the ring so that you can return to it at any time. Now wind up. If your scope has $\frac{1}{4}$ -minute clicks, it will be about 20, if you have $\frac{1}{8}$ minute then obviously it will be about 40.

Now zero in. If you find that you don't have enough adjustment to reach 100 yards, don't worry, this isn't unusual and is caused by the fact that you've mounted the scope exactly parallel to the bore of the rifle.

If you've been reading the earlier chapters, you'll know that your rearsight is always mounted further above the bore than your foresight. This is because we always shoot with our barrels pointing upwards, as a .22 bullet starts to fall to earth immediately it exits the barrel under the influence of gravity; it wouldn't reach 100 yards from the prone position if the barrel was horizontal, because the bullet drops about 14 inches at 100 yards.

So what you have to do is elevate the rear of the tube by packing something underneath the scope where it fits into the cradle of the mount. To start with try a thickness of about 1mm - that will make a difference of about 10mm at 100 yards, so you can see that you don't need very much at all.

Now you can get down to business and find out what you can about your shooting.

Using a scope highlights bad trigger technique. You could find, for example, when you're concentrating on your trigger release, that the crosshairs start bouncing off into the nine ring (particularly in the 3 to 5 o'clock range) and then return to the bull once you've let the trigger go.

This can indicate that you're gripping the rifle too hard and squeezing with the rest of your fingers and palm of your hand, which in turn is putting pressure onto the rifle and forcing it off to one side.

Luckily with your scope you can actually see this happening. As an experiment, try taking your trigger hand off the rifle completely and squeeze the trigger with the minimum amount of contact; i.e. with your forefinger on the trigger and your thumb directly behind on the stock, gently squeeze the two together.

You may not like that as a technique, but it will show through the scope if you're influencing your shots with your shooting hand.

You may find that exerting more pressure with the shooting hand means that the crosshairs stay steadier in the bull; at least now you can see the effect.

It could be that you have a tendency to tense up your arm underneath the rifle, with a resultant rising of the shots on the target; that should also show up in the scope.

Or perhaps you tense your shoulder on the butt, or press down too much with your cheek; whatever you do, you can see some of these things happening with

your own eyes through the scope, as the crosshairs gently bounce their way out into the '8' ring, until you let go.

Try creating these errors on purpose to see what the effect is. It may not be very much but, on the other hand, it could explain some of those mysterious 'nines' which suddenly appear when everything seemed to be going all right.

You may find that you actually get two distinct groups, even when you're shooting very well; particularly at 100 yards you may find that you have 5 shots on one side of the carton and 5 on the other, or any combination.

This could be related to the shot release being on the top or the bottom of your pulse or heartbeat.

You know that your heart's a pump, which is pumping a liquid through your arteries and veins. This creates two distinct phases of the heart - the *diastolic* (when the chamber of the heart fills with blood) and the *systolic* (when it contracts and pumps the blood out into the arteries).

Really top-class shooters who shoot incredibly small groups have the ability to release the trigger on the same phase of their heart each time. Unfortunately they don't know how they do it and they can't do it at will - it's just something which comes naturally with experience and good trigger technique.

However, that technique can be learnt and practised with a scope sight.

This isn't to suggest that you should be trying to pull your trigger on a particular pulse beat just because you can see it. It's more that you lay there and bring your trigger to such a fine sense of balance that it seems to go off by some sort of natural release, without you consciously being aware of it until the shot has gone,

If your scores are *dramatically* better with a scope sight then it may be worth investigating why.

It could be because you can see much better, in which case it may be worth having your eyes checked. It may be because the rifle is heavier, so you could try adding some weights when shooting with your normal sights, but be careful where you put them because weights in the wrong place can have a disastrous effect on your shooting.

It's possible that your head is more upright because the scope is higher than your iron sights, in which case you could try some sight-raising blocks under your normal sights, or it may simply be that you're more relaxed about shooting 'any sights' competitions.

All of these things can be investigated, and the scope may help you discover something about your shooting that you didn't know.

Some scope shooters have got into the habit of adjusting their scope so that they can put the cross hairs onto another part of the target (such as the numbers) rather than the bull.

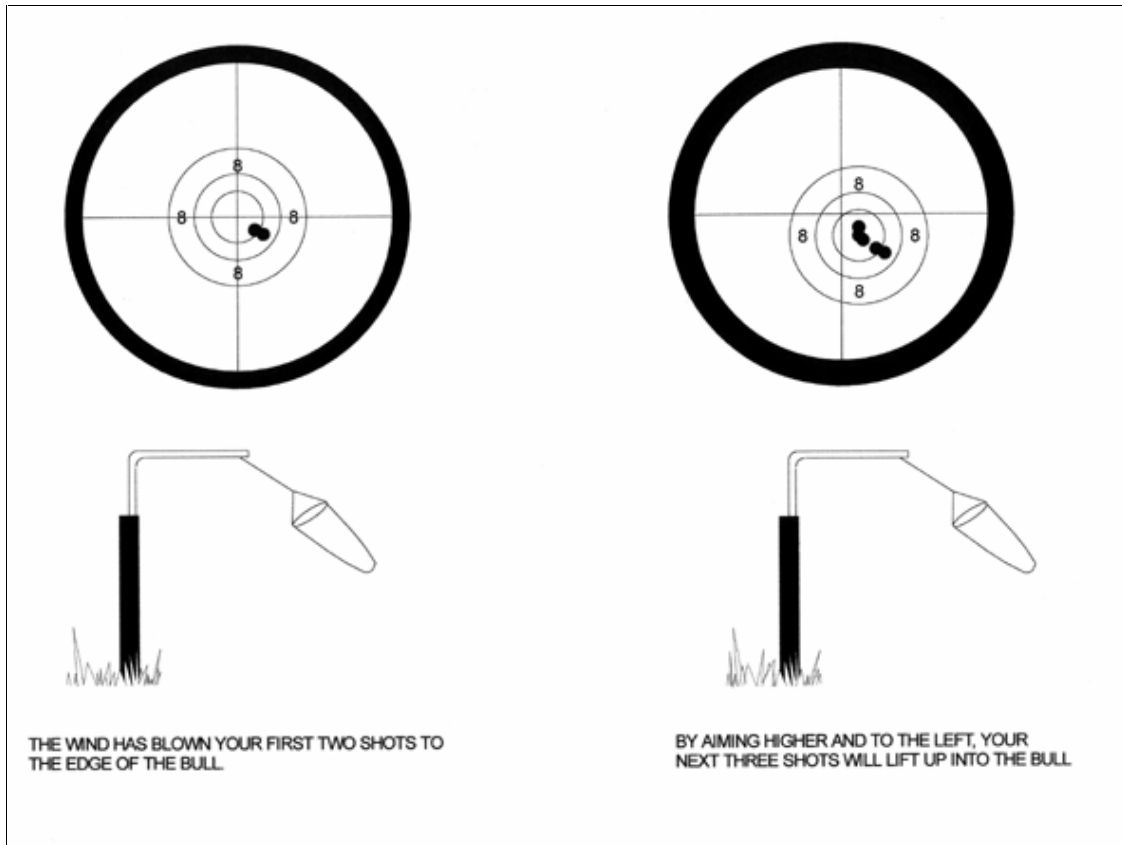
If you try that and you prefer that system, by all means go ahead and use it, but there *are* disadvantages.

The theory is that, if you're shooting at the bull and your groups starts to form off centre there will be a tendency for your eye - and consequently the cross hairs - to follow those shots and spread the group away from the bull.

Actually what happens is, when the group starts to form off centre, you automatically tend to aim towards the area where there aren't any shot holes because that's where you'd like the shots to go. So there's a sort of automatic self-cancelling effect that leads you back into the bull.

Secondly, it's much more difficult to measure the amount of aiming off required when your number is out in the wilds of the 6 or 7 ring, instead of having the width of the bull as a reference point.

If, for example, you've taken a central aim and your first shot is hanging on the edge of the bull a 4 o'clock when the wind is blowing left to right, then assuming the wind is the same when you're ready to take the next shot, all you have to do is put the crosshairs on the edge of the bull at 10 o'clock to ensure a carton bull.



Aiming off with a telescopic sight

Quite often scope shooting is about creeping about on the target, just easing the crosshairs across a little bit more and watching the group form just a little nearer the bull all the time.

It takes a brave man with a great deal of experience to be able to read the wind well enough to put the crosshairs in the 7 or 8 ring and confidently expect a bull, but it can be done and it does only take practice.

Lots of shooters in this country are using the wrong ammunition in their rifles. How to establish what is the right ammunition for your weapon will be the subject of a later chapter, but while on the subject of telescopic sights you will find that scope shooting is the best way of analysing which is the best ammo for your rifle.

All you need is a still day and a few batches of ammo, and you can soon sort out which shoots best through your barrel.

When using your scope for ammunition testing, use the back of a target, or a plain piece of paper so that you don't get tempted to shoot for anything else other than the smallest group.

You can make a reference point to give you something to aim at, but try using the first shot hole and aim at that - it doesn't matter where the rest go, as it's the group that you're after.

Fire a 10-shot group (or a 20, whichever you prefer) and then wind the sight 20 or so clicks one way or the other and use the same bullet hole as the aiming point. That way you can get several groups on the back of a 100-yard card. Don't select your ammunition on just one 10 shot group - it takes more than that to analyse the best.

CHAPTER 10

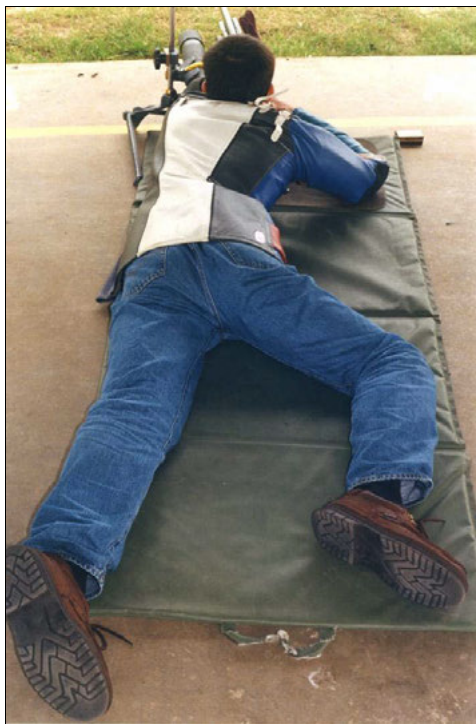
THE PRONE POSITION

As a beginner to rifle shooting you will probably find that the wealth of different positions used by people to shoot prone is very confusing at first. Many of the differences can be explained away by saying that everybody is a different shape, therefore they adopt a different position and there *is* an element of truth in that statement, but it doesn't explain why so many people look so awkward when they're shooting.

If, in trying to achieve the perfect position, you come across a pain barrier then STOP! You're not in this to hurt yourself (you can leave that to the athletes!).

Rifle shooting is not about pain and gain, it's about persistence and gain. You have to develop patience, not turn into patients (sorry!).

There is going to be a certain amount of discomfort because you're going to ask your body to do strange things that it might never have done before, but that shouldn't develop beyond simple discomfort. If you find that you're getting a stiff neck or aching shoulders on a regular basis, then you're doing it wrong.



The prone position from behind

Also remember that, if you're a teenager, you will have a natural suppleness which will allow you to adopt strange positions without any difficulty; if, however, you're beyond the first flush of youth, then please be careful. There may have to be a trade-off between perfection and comfort.

First of all there are one or two basic principles to highlight which you can add to the help you're getting from your fellow club members:

Get as low as you can. Spread yourself out as much as you can. By hugging the ground you'll be more stable, but if you get too low you'll have problems tilting your head back far enough to see through the sights.



Hug the ground

There is a 30-degree rule which applies to the angle between the forearm and the ground. You're not allowed less than 30 degrees, but that's not difficult to keep above, even with a very low position. You just need to keep your left elbow (if you're right-handed) as far forward as possible, then the forearm angle looks after itself.

People with high positions tend to shoot on the point of their elbow, which is not only unstable, but also extremely painful. By getting your elbow forward and your left shoulder down you tend to lay on the back of your elbow rather than on the point, which will be much more comfortable as well as stable.

Shooting with as short a butt as you can, brings your body round behind the rifle, which is a good thing, and spreading your right elbow as far out as you can will lower your right shoulder.

Get the buttplate in towards the base of your neck as far as you can, and don't be afraid to cant the rifle over towards you to get a better fit in the

shoulder. Canting the rifle is good for you as it enables you to keep your head level, which is important.



Get close to the rifle

If you have difficulty in getting your head down behind the sights you can buy sight-raising blocks which will raise the sights up for you (surprise!), but don't use them if you can avoid it because it makes you lift your eye further away from the barrel - or, to put it the correct way - you're lowering the barrel further away from the sight line which is not a good thing. (However, better a high sight line than a stiff neck!)

If you want to see whether you've got your rifle set up in the right way, or if you're starting from scratch, then the distance from the handstop to the trigger should be about the same as from the trigger to the buttplate.

If you're still using a club rifle, ask if you can mark the forend in some way so that you know where the handstop should go, then if someone else uses the rifle after you and moves it, you can return it to your position when necessary.

Your left elbow (or right one if you shoot left-handed) should not be outside the line of the sling when viewed from above, and it should also not be so far over that it's under the rifle - somewhere in between is about right.



Head level - arm under sling

Many people will recommend getting down into position then closing your eyes before you look through the sights; the idea of this is to ensure that your head is in the right position on the cheekpiece and that you're not forcing your head to line up with the sights.

There's nothing wrong with this idea and, in fact, it is even to be recommended to more experienced shooters, particularly if they fit a new item of equipment; it's amazing how much you can try and force a rifle without realising it and by just relaxing with your eyes closed the rifle goes where it wants to, and sometimes that can be along way from where you want it.

Don't be afraid to ask for help in the clubroom; shooters are always pleased to help each other and even the top, more experienced shots are not afraid to ask somebody for help (that's how they got to be top shots).

There's a lot to be said for seeing photographs of yourself when you're in the shooting position, so get a fellow club member to take some photos if you can and then compare them with other people's positions, or pictures you see in this book or others.

Sadly, a lot of smallbore target rifle shooting books are now out of print, but there are two excellent ones still available: *Successful Rifle Shooting* by David Parish, and *Competitive Shooting* by Yur'yev. If you have a local secondhand bookshop and you come across *Smallbore Target Rifle Shooting* by W. H. Fuller, then buy it; it makes very interesting reading; the Bernd Klingner books *Rifle Shooting as a Sport - vols. 1 and 2* have been out of print for a long time but are definitely worth grabbing if you see them anywhere. If only there were more.....

You'll see many top shooters with their right knee drawn up on their mat; this is to lift their diaphragm and heart off the ground slightly, thereby helping to reduce the pulse beat being transmitted through their body from that great big heart muscle directly onto their aim.



Draw the right knee up

How far up to bring your knee is a matter of personal preference; just settle for whatever you find the most comfortable. Adopting this position also helps with your balance; however, by trying to get as low as possible and spreading yourself out you may find that you have a problem with reloading when you lift your elbow off the ground (which is the only way to do it).

What you don't want is for your position to collapse because you've taken one elbow off the ground, so you need to be balanced with very little weight on the elbow of your trigger hand, so that when you lift it to reload you don't disturb your position. By raising your knee you tend to push your balance over to the sling side and take some weight off your loading elbow.

Don't be afraid that you'll get out of position if you lift your elbow to reload. As there's no weight pushing on that elbow, you can easily pick it up and put it down again if the sights aren't aligned on the target after reloading.

Now we come to the fine detail.

Pointing a rifle at the target is not as easy as it looks - anyone can go through the motions, but now it's time to look at refining your position, by paying much more attention to detail.

Let's start with 'eye relief'. This is an expression bandied about by all sorts of people, but for those of you who have no idea what it means, read on.

Quite simply, it's the distance from your eye to the rearsight aperture; altering that distance will affect your sight picture.

There probably is an ideal distance, but because we're all individuals, with differing eyesight, that distance will vary from shooter to shooter. What is

important is that you work out what your ideal distance is by experimenting.

Consider the extremes for a moment: if your eyeball was touching the rearsight aperture, then that would obviously be too close (it would hurt as well) and if the aperture was so far away that you couldn't see the foresight, then that wouldn't be of any use either, so somewhere in between is the ideal position.

You can soon appreciate that, when the eyepiece is very close to your eye you can see more through it than when it's further away, so this means that you can decide how much of the range you want to see through your aperture.

Some people prefer to see little more than the outside edge of the foresight in the belief that they can align the sights easier that way. Others prefer to see more of the range because of the tunnel effect created by being further away.



The distance from your eye to the sights is your personal preference

The closer the aperture is to your eye, the easier it is to get your head out of position, but getting your head in the right place every time is a fundamental part of being in the correct position, and will gradually become something you check automatically each time, without having to rely on the eye relief to tell you.

Most people's eye relief tends to be between 1 in. and 1½ in. and it's of paramount importance that the eye relief is obtained by moving the sight backwards and forwards, rather than moving the head. That sounds obvious, but you must get used to how much you can see through the aperture with your head and neck perfectly relaxed.

If you have a bubble fixed on top of your foresight tunnel, that should be comfortably in view without you having to look up to it (with the inherent risk that you might move your head).

With today's collection of adjustable irises, colour filters and polarisers, you can find you have an inch or more added onto the back of your rearsight, but what is most important is to get the eye relief you need without having to strain any neck muscles, and if that means moving the sight forward, then do so.

A lot of people have had to shorten their backsight base so that it doesn't overhang the breech and make loading difficult; don't be afraid to do this - the older Anschutz rearsights remain quite firm with only one clamping screw, and the newer ones come with a much shorter base anyway.

Be prepared to experiment a little until you find the picture you like, but be warned: if your eyebrow or forehead is actually touching the rearsight, you're too close.

Those of you who use a rubber eyecup and rest your eyebrow against it to locate your head in the right position could be affecting both the recoil of your rifle and the way your sights move. If you have any backlash in your sight, nudging it with your head can move the aperture.

While we're on the subject of eyes, you know of course that your eye should be in line with the rearsight aperture, but when you go from shooting at 50 yards or metres, to shooting at 100 yards, you have to move the sights.

How do you ensure that your eye goes up by exactly the same amount?

Those of you with adjustable cheekpieces probably move them up or down each time, but by how much? Have you ever calculated exactly how much you need to move your cheekpiece to achieve the right head position?



Most modern rifles have adjustable cheekpieces

If you consider that the old Anschutz sight required about 40 clicks up from 50 metres to 100 yards, and each click was .0015 in., then the cheekpiece needs to be raised by 1/16 in. (1.5mm).

That, of course, is a very small amount and needs to be measured accurately, because moving it by 1.5mm too much can be as detrimental as not moving it at all.

There is an argument for not altering the cheekpiece particularly, if you shoot with a cant. Because altering the sight moves the butt in the shoulder, then the cant means moving the butt diagonally by a very small amount from when you shot the last range.

Secondly, the difference that small movement makes to the pressure on your cheek can't be remembered from the previous time so it's better to zero in and remember to be consistent from shot to shot.

If you feel the need for precision, then make up a spacer 1/16 in. thick, which you can insert under (or remove from) your moveable cheekpiece, or construct a pad which you can fix on top of the cheekpiece temporarily to give you the same cheek pressure all the time.

Your overall position should be such that you have no weight on your right elbow (if you shoot right-handed). If you're leaning on that elbow and

gripping the woodwork, then you're exerting another force on the rifle which isn't necessary.



Be gentle with the action

When you've reloaded and closed the action, put your hand back onto the stock at the pistol grip, and then lightly lower your elbow to the ground; the sights should now re-align with the target. If they don't, lift your elbow again and gently place it back in a slightly different position, repeating the process until the sights do line up. Don't try to lean on the rifle or push it over until it lines up on the target.



Close the bolt carefully, it affects your group size

Your position should be relaxed and balanced; if you're relying on your elbow to keep you propped up, then you'll fall over when you lift it to reload. So, don't lean on your elbow, and don't shuffle it around when trying to adjust your aim - pick it up and put it down again.

Your trigger hand should be lightly resting on the stock, with no undue force here either; otherwise it will influence the way the rifle recoils.

The hand under the forend should be relaxed and straight, with the thumb parallel to the stock, the fingers free, and the forend resting on the palm as near the wrist as is practical.

The wrist should be straight and because the forearm is at an angle of at least 30 degrees to the ground, the palm should continue at that angle, then the wrist will be straight and that reduces the strain on the wrist joint.

If in doubt about the straightness of your wrist, get down in position without your glove on, and get someone to photograph your hand from above the rifle, and while they're there, get them to check that your eyepiece lens is at right angles to the line of sight in front of your eye.



Check your hand without the glove on

While you're creating your position, you must also make sure that no part of the rifle is touching the ground. The ideal place for your supporting elbow should be under the sling, or between the sling and the rifle.

If you get too close to the rifle, be careful that the pistol grip doesn't interfere with your shooting jacket at the elbow (you're not allowed to rest the underside of the stock on the inside of your elbow, and with today's large thumbhole stocks it's very easily done).

The average human spends one third of their lifetime asleep, and most of us do it laying down, so the prone position is not that unfamiliar to us, except that we don't usually go to sleep on our stomachs while propped up on our elbows - and certainly not while trying to support 14 lbs. of wood and metal!

Wouldn't it be nice if you could get so comfortable that you could almost drop off to sleep? (Your snoring may disturb other shooters, of course, so sleeping on the firing point is not allowed - at least it isn't at most clubs.)

If you aim to get a position so comfortable that you're completely relaxed, then you can concentrate one hundred per cent on your shooting. The athletes' maxims of 'pain barrier' and 'no gain without pain' don't apply to rifle shooters. Pain to us is dropped points, which is not acceptable.

Pain will interfere with your concentration; rifle shooting is like sex - if it hurts, you're doing it wrong ('more pain, *less* gain').

There is absolutely no reason why you should be in pain while you're shooting - you may be stretching certain muscles which aren't used to it, and they may complain, but that shouldn't reach a level which impinges on your consciousness.

If, for example, your sling arm goes dead while you're shooting, and you get up afterwards with the most awful pins and needles, then you're doing it wrong. Pins and needles are caused by blood returning to nerve endings previously starved of blood, and it's far better not to cut off the blood supply in the first place.

Therefore, keep your sling loose enough to be able to get at least three fingers down between the front of your arm and the sling; that then means that there's enough room for the veins, muscles and arteries to be moved, rather than being crushed against the bone.

Some people talk about having a wonderful shoot after their arm went dead, but everybody has a pulse beat (you'd be dead without it) so to deliberately create a tourniquet around your arm introduces a variable which isn't good for your shooting. So, if you're concerned about your pulse beat, it would be much better to get fit to reduce it, rather than trying to suppress it.

A major part of the overall position is getting the butt correctly positioned in your shoulder, because that's the area which reacts to the recoil.

It's vitally important to know how the rifle reacts against you when it recoils. Because that moment of recoil is so quick, you have absolutely no chance of making any adjustment while it's going on, so it's vitally important to get everything right and consistent *before* trigger release.

It would be impossible to stress the importance of correct butt fit too much; gone are the days when you just lent against a bare piece of wood - now butt plates are extremely sophisticated and the latest ones have a multitude of adjustments. Old stick-in-the-muds will probably tell you that you now have too much adjustment and you'll spend all your time fiddling. They do have a point, but what *is* important is that if you *don't* have enough adjustment to get a good fit, how are you ever going to get it right?

The manufacturers have increased the number of movements on their buttplates over the years, no doubt at the request of the top shooters, so why buck the trend? Back in the Fifties nobody gave any thought to buttplates; they were principally there just to finish off the end of the rifle with a token gesture towards 'fittability'.

Over the years that idea has changed and, as targets have become more demanding, so shooters have got more critical of their equipment and, in their search for the ultimate shooting machine, the butt has become more adjustable to accommodate the odd sizes of some shooters. If we were all the same shape and size then we could all make do with the same buttplate, but you know what life is like!

Looking Back

Before delving into the intricacies of buttplate design let's take you back to why we even need a buttplate at all and, in order to do that, we ought to consider the basics of what happens when your rifle recoils.

Those of you who have been interested enough to take note of the shape of early matchlocks when you've been wandering around the weapons section of your favourite museum, will probably have noticed how, in those days, some butts were very long and some were very short, and they curved steeply downwards, making them appear impossible to fire.

Some in fact were only held to the cheek and did not fit into the shoulder at all, but in those days the powder (and consequently the recoil) was not very powerful.

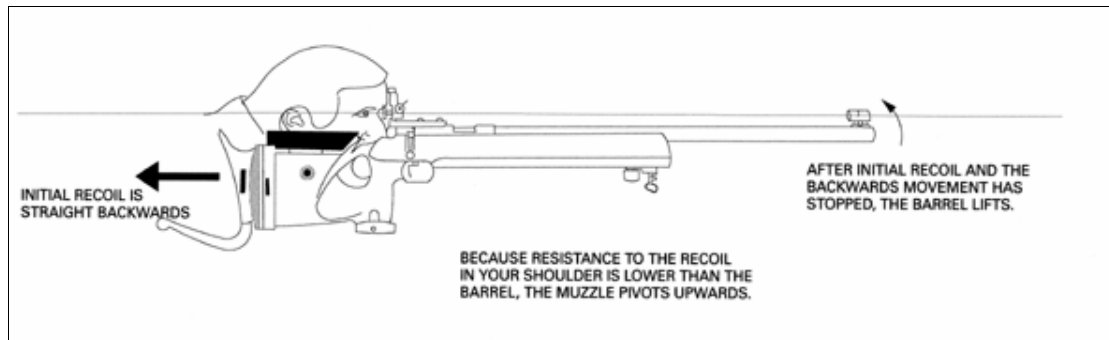
Some butts were placed on the chest, and some were tucked under the armpit while you held a lighted taper to your lock. Originally, the lighted taper was hanging around your neck along with several bags of gunpowder, and it wasn't long before people realised that this was a recipe for disaster, so they attached the lighted taper to the actual gun and operated it with a little lever.

In the early days the buttplate served as protection for the end grain of the stock, giving the gunsmith somewhere to engrave and embellish, so a good quality gun could have quite a fancy buttplate, but that didn't necessarily help it shoot any better, so we will leave the history at that point and leap forward several hundred years.

Because we attach sights to our barrels, and because our eyes are at a higher level than our shoulders, the butts tend to be lower than the barrels. They could be the other way round, but your sights would need to be on tall stalks so you could see through them, and your rifle would react differently

because it would recoil downwards. Just so that you understand quite why this should be so, please refer to sketch.

From that you can see that the initial recoil force reacts opposite to the motion of the bullet and goes straight backwards until it meets resistance in your shoulder. Because the butt is below the barrel, that force is then pivoted upwards and the muzzle lifts.



Why your muzzle lifts under recoil

To digress for a moment - if there is anybody out there who is still confused as to whether slower ammunition shoots higher or lower on a target, reference to the same sketch will help.

Initially, with small reductions in velocity, the bullets at 100 yards arrive higher and higher on a target until the velocity drops low enough to dramatically lower the whole trajectory. This is because the slower bullet takes longer to get out of the barrel and consequently the muzzle has lifted higher. This isn't the whole story - life in shooting is never quite that simple - but as a general principle the above applies.

Now, to get back to our butts (apologies if this is being read in the USA!).

You can see that, if the butt is loose in your shoulder, it will continue in its straight backwards direction for longer, before the muzzle lifts; a tight fit in the shoulder could result in the muzzle lifting more. That could tempt lots of you to say "well doesn't that mean we'd be better off with a loose butt?" The answer to that is "no", because we aren't concerned with how high the muzzle lifts, we're only concerned with it doing it consistently and by the same amount every time.

A loose fit in the shoulder could lead to movement while you're reloading, spotting your shots or scratching your nose, thereby producing another one of those dreaded variables.

Reloading involves moving the shoulder, however you do it. It might just be possible that a few of you are still reloading without lifting your elbow off the ground and are using the rolling technique, and those of you doing that are probably now rubbing your hands with glee and saying to your fellow shooters “there, I told you my way was best because the shoulder doesn't move so much if you leave your elbow on the ground”. But there is bad news for you: rolling over may reduce shoulder movement, but it seriously increases the movement in your supporting arm, and getting it back into the right position is so much more difficult.

With the correct shoulder contact, lifting the right elbow (for a right-handed shooter) is not a problem and if it doesn't go back down in the right place it's a simple enough operation to lift it up and try again. The closer the butt is to your neck and chest, the less it's going to be affected by movement of the shoulder.

Now let's return to the subject of recoil for a moment. The amount of backwards movement will affect the amount of muzzle lift; if your rifle was free to recoil without any backwards restriction it wouldn't go far because the recoil force is dissipated by the weight of the rifle, but it would only be in a straight line.

Supposing you have $\frac{1}{2}$ in. of soft flexible padding between your gun butt and the solid bone of your skeleton, then as the rifle moves back and that padding compresses, so the rifle gradually slows down and the muzzle starts to lift; if that padding was reduced to $\frac{1}{4}$ in. then the muzzle would lift quicker and the shots would go higher. Obviously a similar effect would occur if that original $\frac{1}{4}$ in. of material was much stiffer, because the resistance to backwards movement would be much greater.

How much the muzzle lifts relative to its backwards movement is difficult to determine but just consider that, if your rifle is a yard-and-a-bit long and you're shooting over 100 yards, then one thousandth of an inch of lift at the muzzle is 100 times greater at the target, or about one tenth of an inch, which is half a bullet diameter.

How many 'squeakers' would you have gained if your shot holes had been 50% bigger? That's how many points you would have gained if you'd been able to reduce the variation in your muzzle lift by one thousandth of an inch. It doesn't sound much, but that's how important it is to get that shoulder absolutely right.

There are other things which influence butt contact that may not have occurred to you:

One is nervousness, which results in tension in your muscles, which shows up in your shoulder. How many times have you made a conscious effort to relax, only to find that your shoulders drop? We all unconsciously tense our shoulders when we get nervous or excited and that's transferred to the rifle. When the rifle recoils, instead of meeting soft flabby relaxed flesh, it bumps into hard tense muscle; the rearwards movement comes to an abrupt halt, and the muzzle lifts quicker.

Don't say you don't get tense and nervous before shooting because nobody will believe you (anyway, if you didn't get nervous, it would probably mean that you didn't care what the result was, which means you aren't going to shoot well anyway!)

So we all get tense; what you have to do is recognise that and make a conscious effort to relax. You could argue that if we all get tense, so what? Isn't that in itself 'consistent'? The answer, of course, is "no", because there are varying degrees of tenseness, whereas relaxation is only one state, so it would be far more difficult to get exactly the right amount of tension than to totally relax each time.

The other major consideration is your own personal bodyweight and muscle tone. Those of you who are heavily built will need to pay particular attention to their butt fit. The more muscle you have in the shoulder area, the more in-built variations you have. Spreading the contact point over as wide an area as possible increases consistency, therefore it's very important that the whole buttplate makes very good contact with the shoulder.

You slim athletic types needn't sit back with smug expressions on your faces either, because you also have problems. If you're slim and fit because you play a racquet sport, for example, then your shoulder muscles are well developed and could cause just as many problems as those experienced by your heavier-built colleagues.

Skinny lightweights also have problems because they have bones sticking out, particularly collar bones and, nobody has designed a buttplate specifically to fit neatly round your clavicle. If you don't believe that just get down on the floor with your rifle, with no clothes on (in private please!), and see how your buttplate fits your shoulder.



The butt must fit well into the shoulder

At this point it's vital to realise what goes between your flesh and the buttplate is of paramount importance: folds of material in the shoulder area while in the prone position are bad news. A good well-fitting soft shirt and shooting vest are essential, preferably one of the ribbed type (*Mouche*, *Thune*, *Anschutz*, *Sauer* or similar) which are a stretch fit so that the ribbing adjusts to your shape.

Then the jacket itself must be a good fit in that area; it's no good thinking that the jacket fits well when you're standing up - it has to fit well in the prone position, so ignore the chest size as that's only a rough guide, you should make sure it fits well across the shoulders and up under the arms, and it's vital that there should be no spare material in the butt area.

Get somebody to stand over you on the firing point and look at you from above. Can they get hold of any loose material? If they can, you could be moving that around as you reload and it could alter the thickness of material between the butt and your shoulder. Remember, we're talking in thousandths of an inch, and it's not difficult to vary clothing by the odd $\frac{1}{4}$ in. and that is 250 thousandths of an inch.

If you don't have a top class jacket and you do find spare material that could get in the way, try putting an extra button or a strap up under the chin, to pull the jacket tight across the upper chest and help keep it flat on the shoulder.

Think about the butt area of your shoulder when you're in the shooting position. Can you feel it in your shoulder? If you can't, how do you know it's in the right position? Try to be *aware* of the feel of the butt plate in position, you may have a thick jacket on with padding in the shoulder, but it's important to get that butt in the same place every time, so get used to feeling it.

Changing the butt position minutely will cause vertical stringing on the target, which may be directly or indirectly related, because the butt plate being in a different position will alter the pressure on the back of the rifle, or its resistance to the recoil, hence it will affect the muzzle flip.

Furthermore, you're also affecting the pressure of your cheek on the cheekpiece and that could also lead to a slightly different eye position relative to the backsight. All these things could be working against you - resulting in the sudden '9' at 1-2 o'clock, which you can't explain.

Never be too hasty about analysing a bad shot: very often, as shown above, it can be a combination of things going wrong rather than just one thing.

Once you've got the butt plate at the right height, if you find that you don't have enough cheek pressure to locate your cheek consistently, then you will appreciate the benefits of an adjustable cheekpiece.



A combination of butt plate and cheekpiece should get your eye in the right place

This is one of the exercises to try with your eyes closed: get down into position, get yourself comfortable and place the cheekpiece snugly under your cheekbone. If you're using a modern *Anschutz* rifle and are canting it towards you, you'll be able to use the edge of the woodwork to help you locate your cheek.

If you're using a BSA then you'll probably have a broad expanse of wood, without anything to help you locate your cheek, but you could always stick something onto the stock to use as a locating device (where there's a will there's a way!)

Once you have your cheek comfortably located, open your eyes and look through the sight aperture. If you can't see through it, then you're going to have to move your cheekpiece, or build it up, until you can.

Lots of people hack and carve away at the woodwork of their cheekpieces, in an attempt to get their head behind the sights while still keeping their rifle upright. *Why bother* trying to keep your rifle upright?

It's of no advantage at all and, in fact, it is actually making life more difficult for you. If you cant the rifle towards you, that brings the sights over to *you* instead of you trying to get your eye over to the sights. (There are other benefits to canting, which we'll come to later).

Examine your position.

Now you have the butt in the right place, the cheekpiece in the right place, and you can see through your back sight quite comfortably, get somebody to hold a mirror in front of you at the end of your muzzle (preferably at home on the lounge floor, as this can be a bit difficult down the range).

Examine your position from the front. Is your head level? Are your eyes parallel to the floor? This is very important, both from a comfort point of view and to avoid upsetting the balance mechanism in your ear. (You can, of course, get someone to take a photo of you from in front, rather than using a mirror, but that is not so instantaneous.)

It's not natural to have your head canted to one side and if you were to get down on the floor in the prone position without your rifle, and to look at a target, you are most unlikely to want to lean your head over.

There are, of course, some basic guidelines as to what to do with the parts of your body which are not actually holding the rifle, but their main function, apart from keeping you alive, is to provide a dead weight for the recoil of your rifle.

You'll hear all sorts of wise advice from coaches, instructors, and club experts about your body having to be in a straight line, with your spine straight and your left leg (in the case of right-handers) in a straight line, etc. However there is more to it than that.

What *is* of paramount importance is that your body should be relaxed and comfortable, acting as ballast, or dead weight.

To get the most use out of the rest of your body then you want as much of it as you can get in direct opposition to the recoil of the rifle, which means having as much of it as possible in line with the rifle.

Your shoulders will have to be at an angle to the rifle because that's the way we are built, but there's nothing to stop you bringing your legs around so they're more behind the rifle - just don't bend yourself uncomfortably.

Bringing your right knee (in the case of right-handed shooters) up towards your right elbow will help, and it will also tend to lift your diaphragm up off the floor and relieve some of the pounding of your heart.

You can also use the inside edge of your knee to locate your position, by feeling for the same place every time - like the fold of your shooting mat, for example.

Your feet should be relaxed and comfortable - don't be tempted to allow your toes to contact the ground; lay your ankles flat if you can as there's a tendency to push against your toes, and you could find yourself tensing your body during the excitement of a match.

Try to think of your body as being a dead weight behind the rifle; don't try and use it to steer the rifle, just let it lay there.

KEEP IT LOW

Your body should be as low as you can get it, with two provisos: try to keep your heart away from the ground as mentioned above, and the other thing to consider is the angle of your neck. If you get too low, you could find yourself straining to get your neck high enough to see through the sights.

There are no hard and fast rules here because we all differ in size and shape, but the things to bear in mind are:

(a) You can look quite comfortably out of the top of your eyeball, but that's not how you get your best sight picture - you wouldn't for example, read a book like that, would you? You may also get interference from your eyelashes and eyebrows.

(b) As you lift your head to look more squarely through the sights, so you force your neck back and, if you're not careful, you could affect the blood supply through the arteries and veins in the neck; you wouldn't want to read a book like that either. Restricting the blood supply can cause headaches and blurred vision, so be very careful about how your shooting jacket digs into the back of your neck. Good quality jackets are cut low at the back of the neck and made with soft material to avoid this problem.

Like most things, you are going to have to find a compromise between a low position and keeping your head up, but this is down to you and your individual neck. Just remember *comfort* and *relaxation* at all times.

It's very important not to apply any force to the rifle in order for it to line up on the target. Lots of shooters get down into position, put their left elbow down, lift the rifle into their shoulder and then starting shooting. That all seems fairly straightforward and presents no problem if you've been shooting for so long that your body automatically knows what it's doing, but if you're a beginner, or somebody with only a few years' experience, then it's vital that you get your position correct.

If, when you've lifted the butt into your shoulder and dropped your head down behind the sights, the rifle isn't lined up on the target, then don't force it over until it is.

This is where the idea of getting into position with your eyes closed is expounded by all the club coaches. It's very good as far as it goes, but what do you do when you open your eyes and you're *not* on the target? They all say that you should move until you get it right - that's easy to say but not so easy to do; you could find yourself shuffling around so much during a competition that you haven't got time to shoot.

What you have to learn is what effect moving each part of your body has on which way the rifle points. You'll find that just moving the lower part of your leg a few inches one way or the other can have quite an effect. Learn what that effect is, by seeing how the sights move when you shuffle various parts of your body around.

If, when you get into position, you find that the rifle is pointing into the next county, then major restructuring is required - don't just shuffle around and hope everything comes right.

When you're preparing to get down onto your mat after the "commence fire" order, keep looking at your target as you're getting down - your body will then start to align itself naturally with the target. This may not happen at first, and you may have to persevere, but it is important.

One way of speeding up the process of learning how to get into the right position is by trying the following exercise.

Select a quiet evening down the club when your activities are not going to disturb too many other club members, or perhaps even recruit other members and turn it into a friendly competition.

Get down onto your mat and sight in as normal; when you're confident that you're sighted in, fire one shot to count at your card. Then lay down your rifle, get up off the mat, stand at the back of the firing point, count to ten, then get down again and fire another shot to count without re-sighting.

Continue getting up and down and firing one shot at a time until you've fired 10 shots to count and then have a good rest, because you'll be quite tired by this time.

This sounds like a lot of work, but it will teach you and your body an awful lot about feeling your position, and will accelerate your learning curve considerably. (You'll probably also be quite pleased about how well you shoot, which will give you enormous confidence about your position).

It's very easy, when you're shooting, to ignore something which feels wrong in hope that it will get better, but by getting up and down and only having one shot at the target at a time, it teaches you to concentrate on your position.

The right attitude to take is that each shot counts as one match and it has to be the winner. Getting up and down between shots helps you separate those shots from each other and encourages you to put maximum effort into each one.

The ultimate test, of course, would be to challenge a club member to a one-shot competition, i.e. both visit the range together, get ready to shoot, sight in if you must and then fire one shot at 100 yards for the competition. You can devise your own rules about sorting out a tie (re-gauge, shoot off, or what ever).

With a prize, or simply with prestige, at stake it really concentrates the mind for that one shot. It also teaches you to be sure you're in the right position before you fire, and if you are in the right position for the first shot then hopefully you're in with a chance of getting it right for the remainder.

Look at the different shapes of all the buttplates shown in the photographs. Doesn't it make you wonder what shape *your* shoulder is?



Which one have you got?

It could even make you wonder why you need a buttplate at all. Obviously the manufacturers think you need one, otherwise they wouldn't spend so much time and effort designing the ultimate multi-adjustable piece of engineering which is usually attached to the back of today's target rifles.

We don't need a buttplate to absorb recoil because our rifles are so heavy and the recoil from a .22 is so small that the felt recoil in the shoulder is very small.

If we did need to absorb any recoil then the buttplates would be made of rubber or some other energy absorbing material and it would be very difficult for engineers to design swivelling-rising-canting-extending pieces of equipment out of rubber.

Therefore we can dismiss the need to absorb recoil, so why not just finish off the stock by cutting it off with a saw and leaving a plain wooden end? They didn't even do that 300 years ago when guns were first held up to the shoulder. Pictures of early guns all show them with curved butts - and centuries of gun-making can't be wrong - so we must need something curved to fit into our shoulders.

But -(there's always a butt. Sorry!) do we need the sophisticated piece of mechanical engineering that comes with your new rifle?

The simple answer is that manufacturers aren't going to spend a fortune developing a multi-adjustable buttplate if it isn't going to sell their rifle, but do you buy a rifle because you like the butt, or because you think it's going

to be more accurate? It's probably the latter, and if it happens to have a sophisticated buttplate, then that's a bonus.

Would you still buy the rifle if the manufacturers left off the buttplate and reduced the price by £200? Probably not: it would be false economy to save 10% of the cost of a new rifle if you then still have to fit something onto the end of it, so you accept what the manufacturers put onto the back of your gun.

Nowadays there are a number of buttplates made as 'bolt-on goodies'. So if you don't like what the rifle manufacturer offers you, you can change it. But there has to be compatibility, otherwise you have to replace all the mechanism and that starts to get expensive.

So how do you tell whether your buttplate is right or wrong for you?

In order to answer that, let's go back to basics: if you understand why you need a buttplate, then it will help you to adjust it until it does what you want it to do.

At this stage you're going to have to answer a fairly important question: do you need a hook? If you're shooting 3-positional then you have no choice - you need a hook. But do you need one if you're only shooting prone?

The standing and kneeling positions are much easier to cope with if you're using a long heavy-barrelled rifle, and having the hook tucked under your arm is an enormous help when it comes to coping with any muzzle - heaviness. However, you shouldn't look upon it as absolutely essential, so be careful that you don't rely on it too much; however it can be invaluable as an aid, particularly to those people starting 3-positional.

But back to the prone position: is the butthook a help or a hindrance? The only person who can decide that is you.

So back to basics again: all those adjustments on your buttplate are not designed to move the plate around, they're to move the *rifle* around once you have the buttplate in the right position in your shoulder,

We all have different-sized shoulders, necks, chests and arms so there is no set formula for exactly where it must go, but here are some basic guidelines.

Take the buttplate off the rifle so that you can try it in the shoulder without the rifle influencing where the plate goes. Most of them detach from the rifle easily by just undoing the odd bolt or knob, in fact it *should* be easy because you need to change it quickly and easily if you're shooting 3-P.

Your fitting experiments should be done on the floor: it's no good standing looking out of the window, pressing a plate into your shoulder and thinking it feels comfortable; as soon as you lay down and support your weight on your elbows, then your whole muscle and bone structure moves around and changes the shape of your shoulder.

Lots of you are now thinking "well, it feels great now, but how will it feel with 15lbs of rifle attached to it?" The idea of trying it first without the rifle is to make it easier for you. Try it first without your jacket on so you can actually feel the plate better.

Try to find a place in your shoulder close to your neck and chest, avoiding the large shoulder muscles at the top of your arm. Then, while holding the plate, move your arm up and down and backwards and forwards, trying to find a place that's not so affected by those movements.

If you hold your hand in your shoulder you can feel all sorts of things moving in there when you move your arm, and because you have to move your arm in order to reload you'll have to live with that. (If you're doing this at home on the lounge floor, then it may help if you have somebody to help you - if you can stop them laughing!).

It's not going to take you long to find where you think is a good place for your butt but now you have to do it with the rifle, which is where it gets difficult, because there are so many variables.

Trying the buttplate on its own should have given you a clue as to whether you prefer it canted and, if so, which way. So that will give you an idea as to where it should be on the rifle, but then you have to decide whether you want the rifle canted more in that direction or less.

Get down with the help of someone else, or support the rifle on something if it helps, so that you don't have to hold the weight for too long, as this can be quite a tiring exercise. Then, with your eyes closed, twist the rifle until it feels comfortable and then open your eyes.

With the buttplate adjustment screws loose you should be able to twist the rifle into position, then get somebody to tighten up enough screws to hold it while you're relaxed. You can do the rest up later.

The length of the stock is not overly important, although try to err on the side of shorter rather than longer. Providing your hand reaches the trigger and bolt handle easily and comfortably with your shoulder relaxed and your elbow spread out, being 5mm out in stock length is not important.

Too long a butt can force your shoulder back and cause you to strain to get behind the sights, because you are forced off to one side. Imagine a line in plan view across the back of your shoulders and then think of that line in relation to the centre line of the rifle.



Keep the wrist straight

In an ideal world it would be nice if those lines were at right angles, because that would get all your body weight behind the rifle, which is good for recoil absorption: unfortunately we aren't shaped like that. So you should try not to let that angle get too large, and a short butt will help you do that.

If you then find that your forearm is coming in at too much of an angle, lift the palm of your hand away from the pistol grip and straighten your wrist.

Low barrel lines and high butts also mean better recoil absorption, so look to see where the central line of the barrel comes in relation to your buttplate. As you know, muzzle lift comes from the barrel being above the point of rotation in your shoulder, so expect to get a fairly high buttplate, but make sure that everything is very firm. If you're at the extreme end of the mechanism's adjustability you could be introducing a bending movement.

The height of the buttplate is related to the sights and cheekpiece. Make these adjustments with your eyes closed and take note of how your neck and shoulder feel. Are your muscles relaxed? Is your head comfortable?

Your head is a very heavy object and it can have an influence on your rifle's behaviour. If the sights appear too high when you open your eyes, lower the buttplate or raise the cheekpiece - preferably the latter.

If there's any tendency for you to be looking up to see through the sights you will vary the pressure on your cheekpiece while you're shooting, giving you a corresponding change in point of impact on the target.

Your neck and shoulder muscles must be relaxed when in position, otherwise you're transmitting tension to the rifle - not to be recommended!

It's important that the curve of the buttplate is not too pronounced because, in the prone position, you do need a flatter plate. In the standing position the shoulder is much lower than the rifle and the plate needs to be more curved, so you need a compromise to cope with both positions.

If the buttplate *is* too small then you won't get a good solid contact in the shoulder, which is why manufacturers have now started to put a hinged plate at the top of their butts to enable you to change between positions.

When you think you have the butt in the right place in the shoulder, get a friend to waggle the rifle around and see whether your shoulder is moving by the same amount of waggle. If there's any movement of the rifle before you feel movement in the shoulder then it's not right. If they can easily move the bottom of the butt under your shoulder, without actually moving your shoulder then that's also wrong.

The most important thing is repeatability; the butt must always go in the same place and stay there while you're shooting. You all probably think it - does, but make sure.

The problem with multi-adjustability in a buttplate is that it can be a minefield of wrong adjustments. Time spent getting your shoulder right will be time well spent.

Don't be afraid to make your own adjustments to the butt area. If you have an old rifle with few in-built adjustments, add a few of your own. If you run out of movement and you still have fresh air between your shoulder and the plate, fill it up with something. For example, you could carve a piece of wood and glue it in place; you could start with balsa wood until you get the right shape, then use a harder wood.

If you can't get enough cant, or can't get the plate up high enough, you may have to employ some of your engineering skills or, if you lack these, get somebody else to make you something. Failing that, invent a replacement

buttplate that *does* have all the adjustments you need!

If you get something with half a million adjustment combinations, how can you *not* get it to fit, unless you get lost and find you're spending all your time adjusting the buttplate and not actually shooting?

Now, let's get back to the butthook; have you decided yet whether you want - or need - it?

If not, when you're down on the floor with your trusty friend, get them to feel under your armpit and find out what the hook is doing (you may have to bribe a friend to do this, but it will be worth it!). Is the hook actually touching anything? If it isn't, what's the point of having it? If it is touching, what is it touching, and where?



Make sure the butt hook is not digging into your chest

One major advantage to a good-fitting hook is that it can stop any upward movement of the butt during reloading, particularly if you shoot with a muzzle-heavy position (hopefully you don't but some people may prefer that), so there can be a great feeling of security with a hook under your arm, because the butt feels more secure in the shoulder.

Get your friend - if you still have one after all this - to feel what happens to

the hook while you're reloading; it may actually be causing the butt to move in your shoulder.

Remember, as well, that it's very important to have good friends in shooting, so if somebody is doing all this for you, and they're a shooter too, it's only fair that you should do the same for them.

It's amazing what you can see when you closely observe somebody else shooting. That doesn't mean just wandering along the back of the firing point, it means getting down beside them with a specific purpose, like watching to see if their buttplate moves while they're reloading.

Get everything close to you so you don't have to move very much in order to reload: any movement away from the target while you're reloading *has* to be returned to the exact same spot as when you fired the previous shot - and you should carry out a mental check on this every time - but the less you move the less room there is for error; however, don't strain anything trying to force the rifle to stay in position.

When you think you have the buttplate in the right position, go through the exercise of firing one shot, then get up and stand at the back of the firing point, get down again and get into your rifle, fire another shot, and repeat. Each time take note of how the buttplate feels in the shoulder.

By now you should be getting the idea. You should be able to feel when something isn't right and make a conscious decision to put it right before firing the shot.

Being able to feel what your body is doing is very important or how else are you going to be able to relate that to where the shot went? You can steer your shots around the target by small bodily movements and that's why your shots sometimes don't go where you expected. You weren't conscious of the fact that something wasn't the same as for the previous shot.

Practise getting down into the position at home, the more times you get up and down then the easier it will be. Try drawing a target to scale and sticking it to the wall of your lounge, so that you have a target to relate to as you get into position. Try to get the height about right.

You can even buy some .22 snap caps and actually simulate the firing cycle which will all help speed up the process of the initial learning stage.

Then, the next time you go into the range, you should find it much easier and quicker to get into position.

CHAPTER 11

SIGHTS AND SIGHTING

REARSIGHTS

Every new rifle comes with a set of sights - it would be fairly useless without them - but most people just look through them (and twiddle them occasionally).

Those of you used to sporting rifles, or to pistols, will probably find the idea of looking through a pinhole quite strange, but you should persevere - it really is the best system for target rifle shooting.

The standard-sized rearsight aperture supplied with the rifle will probably be 1.1mm or thereabouts and that's as good a starting point as any. You can fit an adjustable iris if you want to, but we'll come on to that later.

Sights have two adjustments on them: elevation to counteract the bullet drop, and windage to counteract the effect of wind on the bullet.



The bit you look through

Because the sight radius (i.e. the distance from rearsight to foresight) is so long on a rifle, the adjustments can be quite fine and a typical sort of movement per click on a rifle would be 2.5mm at 50 metres, whereas a pistol would be twice that amount.

The modern trend these days is to have a much finer adjustment, but that may be because the standard of shooting has got higher - and therefore more precise - or because the targets are getting smaller. A typical fine adjustment sight will have about 1mm movement per click at 50 metres.

It is actually better to be winding clicks on by the handful rather than tentatively creeping along, one at a time, because if you get it hopelessly wrong you can always go back, and by that time you'll have a measure of where the bull is.

If, for example, your group appears to be in the eight ring at six o'clock, you could wind up ten clicks; if you find that puts you into the eight ring at 12 o'clock then you know the bull is exactly 5 clicks back.

This is assuming that your sights have no backlash, but even if they do, it's unlikely to be more than the odd click unless they're in a really poor state, and while on that subject: it's always worth getting your sights checked at regular intervals, for peace of mind.

Positioning your group with the backsight should be done with a series of shots; don't rely on just one shot because it may not be the centre of your group.

By creeping towards the bull you may get a couple of low shots in the group, which will give you the false impression that you haven't wound up far enough. As a result, you add on a few more clicks and then you get a couple of high shots, which makes you want to come back down again. This all tends to create uncertainty.

Analyse your group after three or four shots, then move the sights - don't keep moving them while you try to figure out where your group is.

Some people recommend adjusting only one direction at a time but the only 'plus' side to that is that you only have one knob to twiddle.

If, for example, you decide only to adjust the elevation until you get that right but you find that the holes are still off to one side, you can then adjust the windage, but (there's always a but) you'll probably still need some elevation adjustment when you've finished with the windage, so you may as well do both together (particularly as you should be shooting with a cant,

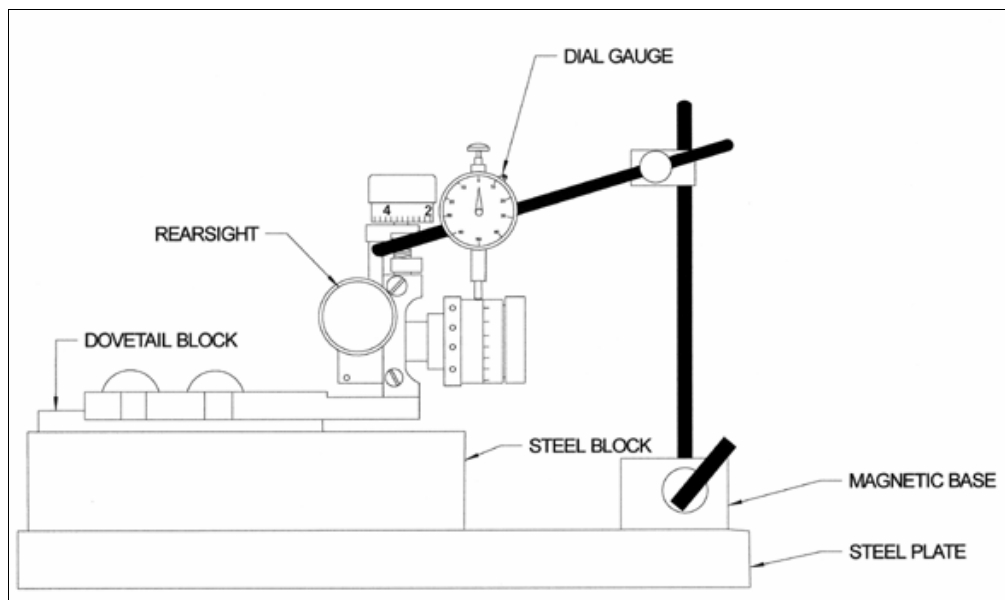
which means that you can't think of the bullets going strictly up or down; they're more inclined to be at an angle, depending on your degree of cant.)

You could get lucky of course and find that, if your shots are all in the nine ring at 4 to 5 o'clock, all you need is a bit of elevation.

It's a good job that we don't shoot at 200 yards as the bullet drop is so enormous that there wouldn't be enough clicks on our sights to accommodate it. (Imagine having to wind up 300 clicks - there really would be a lot of sore fingers around.)

One reason your sights must be kept clean - but not oily - is because all that winding up and down can force any dust on the threads into the moving block and create more wear and tear than you would really like.

So please check your sights regularly and always give them a quick look over before you shoot.



Get your sights checked regularly

A useful little tool to have in your kit is a small camera puffer brush (available from any decent camera shop); it will brush your sights clean and, by squeezing a bulb on the end, it sends a jet of air into the bristles to blow any dust away.

Any aperture that is basically just a plain hole will tend to keep fairly clear, but as soon as you add a filter or use an adjustable iris then you're asking for trouble: an adjustable iris is made up of interlocking moveable leaves and they're just right for trapping hair, dust, straw, grass, seeds, or anything else which happens to be drifting about on the wind.

The same thing happens with a filter. Glass is better because it doesn't attract dust like plastic, but more importantly, by blocking up the hole in the aperture with the filter you effectively stop any movement of air through the hole. This, movement, while not noticeable, is enough to keep it free of any airborne rubbish which just might have been tempted to take up residence across the bit you look through.

Another useful tool in the sight-maintenance department is the magnifying glass - and the more powerful the better; what appears invisible to the naked eye becomes a tree trunk under 20x magnification.

A human hair stretched across your aperture will have a disastrous effect on your shooting so if you're having a bad shoot for no apparent reason, examine your sights for signs of foreign bodies.

Hence the reason for checking your sights before you shoot; leave nothing to chance, because if you do you'll be tempting providence. The one thing which goes wrong in a shoot will be the one thing you didn't check.

Whether you leave your sights permanently attached to your rifle, or take them off and put them on each time you shoot, is a matter of personal preference (and depends on the size of your rifle case).

It's a good idea to take them off, because handling the sights each time gives you the opportunity to check them. You need have no fear of not getting them in the same place each time - rifles usually have markings on the top of the receiver to aid repeat placement (if yours doesn't you can soon mark it).

If you really want to look after your sights then you could carry and store them in a special case separate from your rifle, but *don't* leave them behind on the kitchen table when you go off to the range!

If you were to go and get your sights right now and examine them under a magnifying glass, fifty per cent of you would find some form of pollution on them, so now would be a good time to clean them.

You don't have to take them apart - just clean out all the crevices and the aperture. Even if you only give them a good blow with your mouth, that would be something (but take the filters off before blowing just to avoid your warm moist breath getting water on the glass).

And don't just use any old brush for cleaning, make sure you're not leaving more hairs behind than you're taking off or, better still, use the puffer brush mentioned above.

Remember your sights are a precision optical instrument and should be treated as such; they're very expensive to replace but, properly looked after, they could last you a lifetime.

Obviously the sights all have to serve the same function - i.e. they have to help you align the rifle on the target - and how they do that will be basically similar in all cases; but there is room for improvement on the basic system and it's entirely possible, by applying a clever design technique, to make things easier for the rifleman.

The best sight picture can be obtained with a ring foresight and a pinhole aperture rearsight, but in the early days of target shooting various experiments were carried out to get an even better sight picture.

While everybody agreed that an aperture rearsight was good, it did produce its own problems and one of these was that light was refracted around the edge of the hole, which means that there are scattered light rays bouncing around between the hole and your eye.

This is a phenomenon which can't be stopped (it occurs even on a pistol sight) but it was thought it could be reduced.

By ensuring that only the light from the target reached the eye, it was calculated that the amount of extraneous light interfering with the sight picture could be reduced. Because of this, the first experiments consisted of a continuous tube from the foresight to the rearsight - like a very long, thin telescopic sight but without any lens.

You may even have seen rifles with long thin tubes above the barrel in films or in old illustrations.

The theory was good, but in practice there didn't seem to be any significant improvement; however, because the theory was good you will still see various tube rearsights and anti-glare tubes today.

The modern tube rearsight has a tube which doesn't extend beyond the receiver of the rifle but the original principle still remains: by concentrating the light from the target into the rearsight - and because the target is far away - the light reaches the eye in straight, parallel lines.

Over the years several manufacturers have produced tube sights so you'll regularly see a variety of these on the firing point, although some are no longer in production.



A tube sight

The construction principle is the same for all of them. They all have a tube fixed and pivoted at the front, and the windage and elevation screws push on the outside of the tube at the back end, against a diagonally opposing spring.

This method of operation has an added advantage in that it removes backlash. (Any threaded machine screw used to move something backwards and forwards has a built-in design problem called backlash.)

This is when, after winding a thread one way there's a hesitation before the threads take effect when you wind in the opposite direction. Anyone who operates any sort of machinery will recognise this fact.

Modern sights have reduced this problem to a minimum but it's still there and as sights get old and worn so it will increase.

Tube sights have eliminated backlash by using an opposing spring which ensures that the threads always have a constant pressure in the same direction, so it doesn't matter which way you turn the thread, it will always be in contact.

The manufacturers of tube sights also tend to plump for much finer movements per click in their adjustments, so instead of about 1/6th minute clicks they may have 1/10th or more.

Just to digress at this point: you may hear shooters talking about how many 'minutes' their sights move; if you don't understand what they're talking about then read on.

The 'minutes' they're referring to are an angular movement which gives a formula for the distance the bullet moves, depending on the range at which you're shooting, relative to the distance the backsight moves.

On the Continent they use a different system so if you have a German rearsight the instructions probably say something like "each click is 1mm (or 2.5mm) at 50 metres."

In this country we refer to that movement as 'Minutes of Arc' or 'M.O.A' for short. An arc is a portion of the circumference of a circle and can be represented by an angle at the centre of the circle.

A full circle is 360 degrees, and an arc which is a quarter of the circumference would give a 90-degree angle at the centre of the circle.

A degree contains 60 minutes (and each minute has 60 seconds but we don't use them in the rifle shooting world), therefore a full circle is 360 x 60 minutes.

Now you can work out exactly what each 'M.O.A.' is at each range by using the formula for the circumference of a circle which is, as most of you remember, $2\pi r$, where 'r' is the radius of a circle (or the distance to our target) and π is 3.142 to three decimal places.

So, if our range is 100 yards, then 'r'=100 which is 100 x 3 x 12 = 3600 inches. So the formula works out like this:

$$1 \text{ M.O.A.} = \frac{2\pi r}{360 \times 60} = \frac{2 \times 3.142 \times 3600}{360 \times 60} = 1.047 \text{ inches}$$

This means that one M.O.A. at 100yds is 1.047 inches and, therefore, if your sight is rated at 1/8th minute clicks, each click will move the shot approximately 1/8th inch at 100yds.

It will be *pro rata* at longer or shorter distances (if you don't believe me, just substitute the different ranges into the above formula).

Those of you with foreign sights who have been told that one click moves the shot 2.5mm at 50 metres, can use the same formula to find out your M.O.A.

$$1 \text{ M.O.A.} = \frac{2\pi r}{360 \times 60} = \frac{2 \times 3.142 \times 50,000\text{mm}}{360 \times 60} = 14.5\text{mm}$$

Therefore 14.5 divided by 2.5 is approximately 6 so your sights are approximately 1/6th M.O.A. sights and, as such, will move the shot about 1/6th of an inch or 5/32" at 100 yards. (And you thought maths was *boring* when you were at school!)

But back to our tube sight; the reason that the tube was pivoted at the front was that if it wasn't, the tube would rise parallel to the barrel as you lifted the sight to shoot the longer ranges. As the tube gets higher so you have to look through it at a more downward angle to see the foresight.

The inside of the tube has to be rough and extremely matt black in order to avoid any stray light bouncing its way down the tube to your eye. This

means that you may find the inside is grooved with circular grooves, or even threaded, or it may even have a big spring inside - anything to ensure that only truly straight and parallel light rays reach your eyes.

Lots of people prefer the finer clicks of tube sights because they find coarse clicks means they tend to leap about across the bull, and they prefer to 'ease' their way across.

However, don't be fooled into thinking that just because you have an anti-glare tube stuck out in front of your rearsight, you have the next best thing to a tube sight, you haven't! While anti-glare tubes will obviously help eliminate some extraneous light they are a poor substitute for the real thing.

Tube sights don't require any extra maintenance, apart from just making sure that no dirt or foreign bodies become trapped inside or around the adjustment screws on the outside.

They will all take the normal standard-sized adjustable irises in the back, and will all fit onto normal Continental-made rifles. BSA owners are a special case but there were even tube sights made for them.

Tube foresights are just generally longer and bigger in diameter than normal and you might find you get a better sight picture through one, but there's no particular advantage, and it's all down to personal preference.

If you're going to experiment with a longer tube foresight or lots of anti-glare tubes stuck in the front and back of your existing one, then a word of caution: whatever you do don't let anything project beyond the end of your barrel; it could have an effect on the escaping blast of gas from your muzzle which could in turn affect your bullet (and you wouldn't want that would you?)

So to sum up: there are no disadvantages to using a tube sight and there could be positive advantages in finer clicks and concentrating the light towards your eye, but before you finally make up your mind, read about some of the other sorts of sights that are available.

THE FORESIGHT SAGA

The foresight is an often-forgotten or ignored piece of equipment - stuck on the end of your barrel in just the right place to catch on your gunslip while you're struggling to remove your rifle. Apart from occasionally changing elements in an effort to make up for a bad shoot, lots of people tend to ignore this lump which is three feet nearer the target than their eye.

Let's examine the foresight in all its glory, and tell you why you should take good care of it, and give you some idea of what 'bolt-on goodies' are available for it.

First of all, the foresight is the pivot of your sighting system; it's the bit that stays still while you wind the butt of your rifle up and down or from side to side.

When you look at a target, the light from that target reaches your eye in a straight line (apart from when mirage occurs) and, by interposing your sights on that line you have the ability to align your rifle barrel with the target. If your bullet doesn't then arrive in the middle of the target, you can wind your rearsight in several directions, which adjusts the butt in your shoulder, leaving the foresight exactly where it was.

If your foresight had some form of vertical and horizontal adjustment, you could of course alter that instead of the rearsight and it would have the same effect, but it would be considerably more difficult to do (unless you have arms three feet longer than average).

Over the years, target rifle sights have evolved from the blade and 'V' system (still found on sporting rifles), into the ring and aperture system that we use today. Although this particular type of system had been in existence for a long time, it only really found favour when target shooters settled on using round targets.

However, that's not to say that the blade and 'V' system *wouldn't* work - pistol shooters still use it, even with round targets.

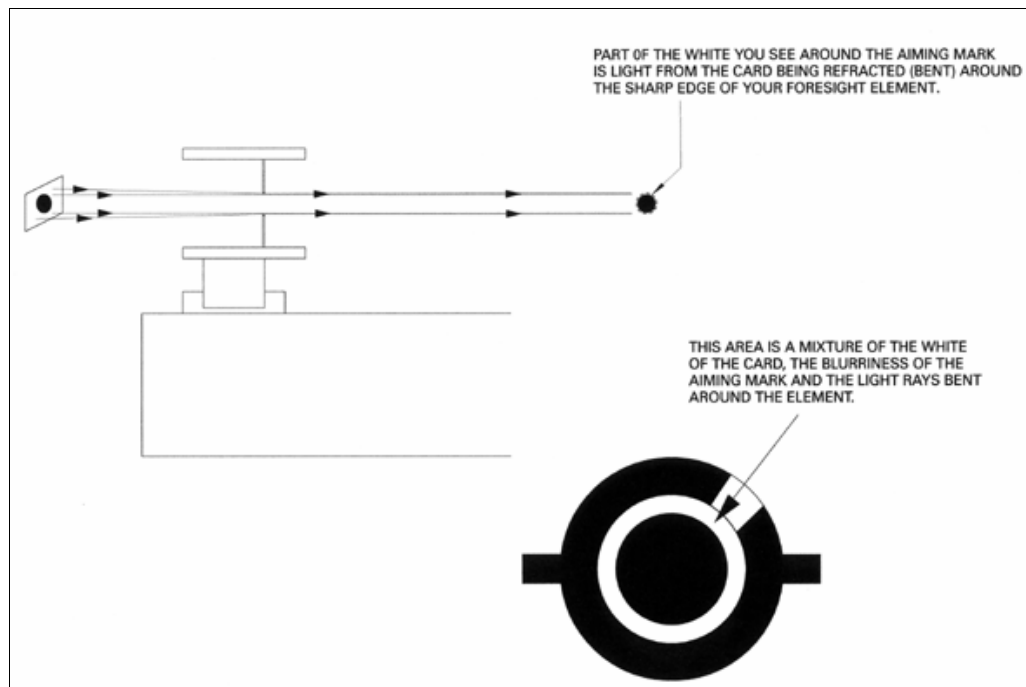
It's perfectly possible to use a blade foresight with an aperture rearsight - in fact even today some people are reluctant to change to a ring. There is certainly a case for using a blade in the less stable standing position where, instead of waiting for the target to wobble into the ring, you could well find it easier and less frustrating to position the aiming mark on top of the foresight blade, like a pistol shooter.

Pistol shooters use a technique known as 'area aiming' which basically means that they locate the top of their blade foresight in an area at 6 o'clock from the aiming mark, and well below it, so that they're aiming at a *general* area instead of trying to balance the aiming mark exactly on top of the foresight. Providing the sights stay perfectly aligned with each other, the area is relatively small (usually smaller than the bull).

Unfortunately, it's more difficult for a rifle shooter to shoot this way because there's a greater tendency to introduce an angular error caused by the butt being fixed in the shoulder. However, if you're a budding 3-P shooter and are terrified of your inability to hold the target in the centre of your foresight ring, you could try a blade temporarily until your hold gets

steadier.

If you do try this, experiment with different blade widths until you find one you like, but as a guide, look for one which is the same width as the apparent width of the aiming mark.

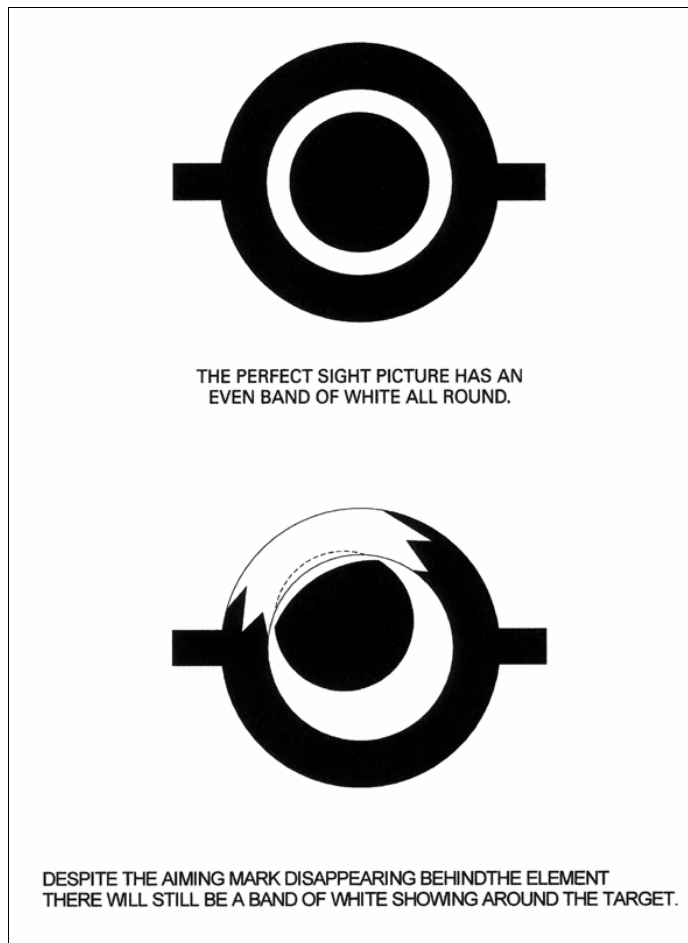


What you see is not necessarily what you get

Most people nowadays use a ring foresight for normal target rifle shooting but, of course, rings come in different sizes and widths, and can present a bewildering array of alternatives for the beginner. This is where you might find a few general guidelines of some assistance:

Remember that, however small you make your foresight ring, you will still see some white around the aiming mark. This is not necessarily the white of the card, because the light actually reaching your eye from the target is refracted around the inside edge of your foresight ring, instead of travelling in a straight line.

So while it's unlikely that anyone will use a foresight size smaller than the apparent size of the aiming mark, if you do use too small a ring, you may not notice when the aiming mark is off centre.



The disappearing aiming mark

Within reason, therefore, the larger the foresight you use, the easier it will be to notice if the aiming mark starts to wander off centre.

Older eyes will be helped by a larger foresight as they will find it less tiring, but although younger eyes may have a visual acuity which enables them to use a smaller foresight it, doesn't necessarily mean that they will shoot better groups that way.

There are a lot of myths, rumours and superstitions relating to the size of foresight you should be using. Some very strange sizes have been used from 2mm to 5mm, with a variety of reasons being given, ranging from "I don't know what size is in there, my dad looks after that", to "I tried a larger one but I could have driven a bus through it, and the target looked like a pea in a bucket".

So, let's get one thing straight: there is only one way of deciding which foresight size to use - use the one that produces the smallest groups. That sounds like a cop-out, and how do you decide which shoots the best groups?

You *have* to experiment, and you have to do it over a fairly lengthy period of time. (Remember, the more samples you take in a survey, the more you can rely on the answer). Everybody's eyes are different and what suits one person won't suit another, so just because the best shot in the club uses a 3.4mm that won't necessarily be the best one for you.

In shooting, nothing is ever achieved in a hurry; take your time and be prepared to analyse a lot of scores (this is where a shooting diary becomes essential). Try different sizes of foresight, but keep an accurate record of everything which may have also influenced the way you shot on each occasion.

It's no good suddenly jumping from a 2.8mm to a 4.5mm, having a rotten shoot and sticking slavishly to your 2.8mm for the rest of your life.

It's a fact that the perceived size of the aiming mark grows to match the size of the foresight, so if you suddenly change from a small to a large foresight size, the aiming mark *does* look like a pea in a bucket. However, if you increase the size gradually, or if you persevere with the large one despite the initially strange sight picture, you'll notice that the relationship between the aiming mark and the inside of the foresight ring alters, and the size of the white around the aiming mark changes.

So what's the point of choosing a larger foresight if it all looks the same anyway? Good question.

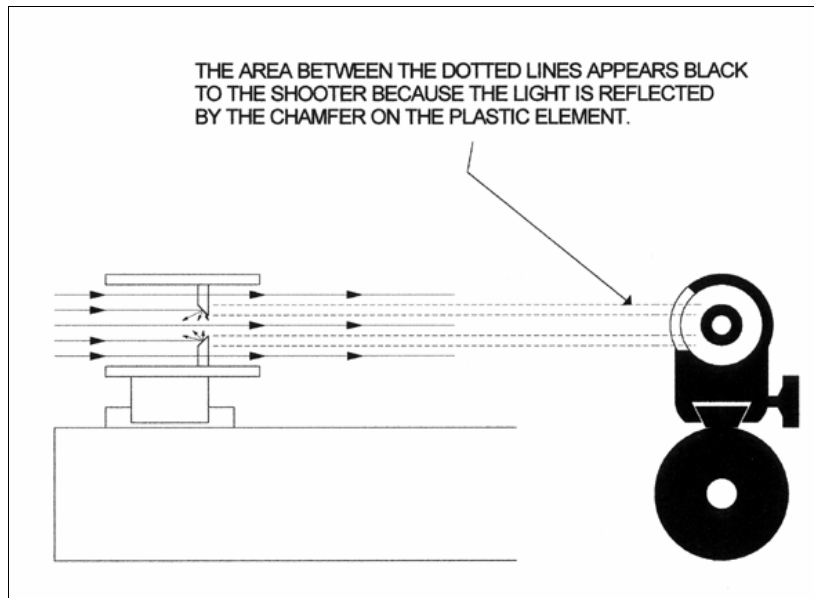
The answer really goes back to you using what produces the best groups, rather than what produces the best sight picture. Remember that (as you'll find out in chapter 13) seeing is not always believing! So your sight picture may *look* perfect, but it may not be the one that produces the best group.

A good starting point for your experiments would be a 3.8mm foresight size, which is large enough to enable you to aim off comfortably, but not so big as to make the aiming mark look like a pea in a bucket. You can then go up or down, from there in 0.1mm steps, or you could even get a colleague to select different sizes for you without letting you know what they are.

At the same time you can also experiment with both metal and plastic elements to see which you prefer.

Lots of people nowadays have changed from metal to plastic elements, as they find that the horizontal or vertical bars used in metal elements detract from the ideal 'concentric circles' sight picture. Although the bars are a good way of keeping a check on your cant, there are other ways of doing this, using levelling bubbles or external bars for example.

If you hold a plastic element in your hand, it doesn't appear to have a black ring around the hole, but when it's installed in a foresight tunnel (where the only light reaching it is at right angles to the plastic) the chamfer around the edge of the hole reflects all the light and so looks black.



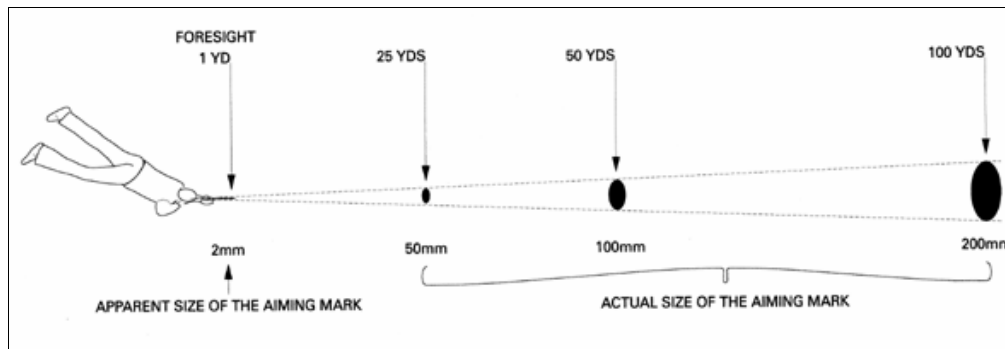
How clear can be black

Some years ago plastic foresight elements were widely available in a variety of different colours which then also acted as filters. However, these have now generally fallen by the wayside and most people choose very pale pink elements, which only really show any hint of colour when laid on a white surface. That way, the colour of the filter you use in your rearsight doesn't become distorted by the colour of the foresight element.

At one time the metal elements were available with a choice of inner ring thicknesses, but nowadays only the larger Anschütz sizes come in 'thick' or 'thin' and whereas the Parker-Hale (BSA) elements are often fairly thick, the general trend seems to be towards a thin ring.

As far as plastic is concerned, it's very difficult to find differing thicknesses, and altering the chamfer could interfere with its light-reflecting capabilities. It shouldn't be necessary paint the chamfer black, but if you like a really thick ring then this may be the only way.

However, if you're having difficulty focussing on the standard ring of a plastic element, it may be that you need a shooting lens, which could be of more benefit generally than just thickening the ring.



That little black dot in your foresight is about 2.00mm diameter

But why bother with a hole at all - why not just print a black circle on the plastic element? Well, basically, plastic can easily be scratched and any scratch inside the ring could interfere with the sight picture. While you might notice a large mark, tiny scratches inside the ring could build up and distort your sight picture without you being aware of it.

Although this is less of a problem outside the hole, you could still end up with some strange light effects, so obviously it's in your interest to handle the elements with care and keep damage to the minimum.

It's essential if you change over to plastic elements to make sure that you cover the slot in the top of the tunnel, to avoid any light getting in there and interfering with the blackness of the ring.

One thing which may complicate your experiments is the weather or, more accurately, the light. Generally, as the light gets brighter, so the aiming mark appears to shrink, which means you should always be prepared to alter your foresight size as light levels rise and fall.

Looking back through your shooting record you may find, for example, that you shoot better on bright sunny days with a smaller foresight (which wouldn't be unusual) so you could then decide on your foresight size in advance, depending on whether it was a bright or a dull day.

In the old days there used to be a difference between the perceived size of the aiming marks at 100 yards and 50 metres, and it used to be necessary to alter the foresight size by 0.1mm or 0.2mm to retain the same apparent sight picture.

Nowadays they're the same and it would nice to be able to say that the foresight which produces the smallest groups at 50 metres, should also produce the smallest groups at 100 yards.

However, the problem with shooting is that you can't be certain of anything and if you find that you get smaller groups with a different foresight size for each distance, then go ahead and change it for each distance.

All this foresight changing for different light conditions, different distances, etc. can be a real pain, so the manufacturers have produced gadgets which make life easier - namely adjustable foresights where different sizes of aperture can be selected by the twist of a dial and, in some cases, different thicknesses of ring can be chosen as well. With one of these there's no excuse for not having the right sized foresight.

BOLT ON GOODIES

A bare foresight is all very well, but there are items of equipment on the market that you can add to that tunnel to improve your sight picture: an anti-glare tube for example. Of course, some people may already have bought an anti-glare tube for their rearsight, so what would be the advantage of having one on the foresight?

Well, everything you look at can only be seen because it reflects light and, in the case of outdoor shooters, that means sunlight, even if it means that it's reflected through several layers of cloud on a dull day.

In effect, then, there are millions of light rays all bouncing around higgledy-piggledy, making straight for your eyeball the minute you look in their direction.

As a shooter, the only thing you usually want to see is the target, and anything which helps you concentrate on that target must be an advantage; that's right isn't it?

Well, yes, maybe. 'Maybe', because you can have too much of a good thing. If you were to have a tube which stretched from your eye to the target, although it would certainly help you concentrate on the target, it wouldn't necessarily give you a better sight picture.

Foresights can be very short in relation to the total sight radius of the average rifle, which means that they don't do a great deal to keep out all those extraneous light rays which are bouncing off your rifle barrel. So, it would be worth considering lengthening them, to cut out all this light which is bouncing around thereby giving you a nice clear sight picture.

One of the distinct advantages of dealing with light is that it travels in straight lines (most of the time); therefore you don't have to protect your foresight with a very long tube before the only light reaching it is the light

from the target and its immediate surrounding area. All you're really trying to do is ensure that the light reaching your eyes is coming straight from the target.

So how long should a foresight tube be?

That's easy to answer: long enough to ensure that the foresight ring doesn't disappear into a mass of light rays bouncing about all over the place. On that basis, you could find that the average foresight tunnel (approx. 35mm) is sufficient for most light conditions.

However, some outdoor ranges point in a less than the ideal direction; for example, not quite north could mean that you're shooting obliquely towards the sun and your foresight is being illuminated by light you could well do without. In those circumstances you could plug in your faithful anti-glare tube (which is relatively inexpensive) and - like magic - your problems are solved!

You could even have anti-glare tubes in your foresight permanently, but on the whole it would be better to use an anti-glare tube to solve a problem when it occurs, rather than making it a permanent fixture which is only of use on certain occasions.

Psychologically there is nothing more rewarding than being able to use something as simple as this to solve a problem when it crops up.

So, anti-glare tubes are a 'yes', but use with discretion.

Now, how about treating yourself to a really expensive miracle of modern engineering, i.e. an adjustable foresight ring.

We know how useful it is to be able to change foresight sizes for different light conditions and, let's face it, if there was an ideal foresight size for all shooters to use in all circumstances, there would probably only be one available. But nothing is that straightforward, and different conditions demand different foresight sizes, so let's consider a gadget which does away with all those separate elements laying around in the bottom of your bag.

One quick twiddle of a knurled ring and you can go from a 3.0mm aperture to a 4.2mm, or stop anywhere in between - doesn't that sound attractive? Imagine being asked what foresight size you use and being able to answer "3.75mm" - a size which doesn't exist amongst the commercially available individual elements.



Adjustable iris foresights

Obviously it's not particularly vital to be able to go up or down in sizes less than 0.1mm but what *is* important is that you find a size which suits you in whatever conditions you're facing at the time. If that happens to be 3.75mm or 3.37mm, who cares? It's what works for you, and if you can get there by a simple twiddle of a knob, rather than sorting through piles of metal or plastic elements, so much the better.

You may also find, by way of a bonus, that it's easier to focus on the ring of an adjustable foresight because they tend to be thicker than the rings on plastic elements, and they appear darker because they are actually black interlocking leaves which reflect no light at all.

The cheapest form of adjustable foresight is simply an iris arranged like the adjustable iris in a rearsight, but it has a bigger hole in the middle. For around £70 you could fit an adjustable iris to your foresight, but be warned: being the cheapest, it does have one minor drawback.

This particular type usually only adjusts the *inside* diameter of the ring, with the outside diameter staying constant. This means that as you alter the aperture size, so the thickness of the black ring surrounding your aiming mark will alter, i.e. a small hole gives you a thick ring, and a large hole leaves you with a thin ring. That isn't, of course, what happens when you change individual elements - in that instance the ring thickness stays the same.

This can lead to a certain amount of confusion, because, if you find you shoot better with a larger foresight size but you're using an adjustable iris,

you won't be sure whether it's the size of the aperture which suits you, or the thickness of the black ring.

However, having the ability to change your foresight size relatively easily will be more of an advantage than using interchangeable elements (which most people rarely bother to change to suit the conditions), so if the cheapest model available is more suited to your budget then it will still work to your benefit.

But if you set your sights higher and aim for a better class of (i.e. more expensive) adjustable foresight then it's possible to adjust the aperture size without altering the thickness of the ring.

These are much more sophisticated and work on the principle of a tube made up of interlocking leaves fixed to a plastic plate at each end. Adjusting the size of the inner aperture also adjusts the outer diameter, so the ring thickness remains the same. At a cost of some £100 or more, they're not cheap, but with care they could last you all your shooting life (and if you're not quite so careful, the manufacturers will always service them at a reasonable cost!).

Moving up the scale brings you to the all-singing, all-dancing complete replacement foresight with adjustable aperture, adjustable ring thickness and a canting facility as well. Prices are around the £160 mark, but if you want the ultimate in adjustability, this is it, and only you can decide whether it will help your shooting.

If you think you're shooting with exactly the right aperture size and ring thickness in all light conditions, there's probably no need to change. However, if an element of doubt exists, you could certainly make life easier by having a gadget which enables you to experiment with different combinations of foresight size, ring thickness, etc.

Some of the 'screw-in' marvels include bars which appear in the foresight tunnel; sometimes these are just horizontal bars which are reminiscent of the old metal elements, and sometimes they're sophisticated pieces of equipment, which can turn horizontal bars into a crosshair system. These are all a matter of personal choice, so you'll need to examine each one and evaluate which you think you would prefer.

If you do decide to opt for something like this, then use your common sense; don't just twiddle all the knobs in a random fashion and hope you end up with the right size. If you're going to get the best value from your investment, you must use it wisely; experiment with different sizes and (if appropriate) ring thicknesses and - above all- keep records!

There's no point in shooting at an open meeting in bright sunny conditions and not remembering what size foresight you found gave you the best results when you were practising on your home range.

Of course, if you never even think of changing your foresight size to suit the conditions you could be missing out on a chance to improve your scores. However, if you do hope to improve then you must remember that no scientific experiment ever succeeds without accurate and detailed records being kept.

Looking through your records you may discover that you use a 3.8mm most of the time - it stands out like a sore thumb - but on the occasions when you've changed to something else because of exceptionally bright or dull conditions for example, it's all in the records.

Sometimes the addition of a new accessory can lead to a brief improvement, which seems to evaporate all-too-soon when the going gets tough.

This very often is a temporary psychological boost caused by you *thinking* that you're going to shoot better, or by you *believing* you can see better through an adjustable five-colour-filter set; there's nothing wrong with that at all, what you have to do is make it last. That comes from having confidence in what you're doing, which in turn comes from you having thoroughly analysed the effect that a new piece of equipment has had on your shooting.

If you know that you shoot better with a smaller foresight ring on a sunny day, then you'll adjust your foresight accordingly before you start shooting. This means you'll shoot with confidence, without worrying about whether you ought to be using a different size, as you've already proved to yourself during practice that this is what works best for you.

Some shooters literally rocket from 'C' class to 'A' class simply because they have used a bit of analytical practice on the range. However, if you wonder why you don't see 'X' class shooters wandering about with record books noting down every detail, it's probably because they've already done all that, and their formula for shooting is locked into their brains; they don't have to look up to see what size foresight they need to use in a particular condition, they've done it so many times before that it becomes a natural reaction.

So - keep records and think about what you're doing; don't just pump lead down the range.

If you're not confident of your ability to analyse the effect of a piece of new equipment, use some sort of a rest - either a sandbag or a bench rest (home

made or purchased). That will help remove some of the other shooting errors which could give you a false reading on your analysis.

Always keep an open mind and don't dismiss something until you've tried it thoroughly - firing 20 shots down the range and deciding something doesn't work is *not* a fair trial - you need to try it for a few weeks at least.

If you think you have a problem, ask around to see whether anyone else has had the same problem and try to find out how they cured it.

Some people love attaching all sorts of home-made equipment to rifles - some of it very ingenious, some of it not so clever - but you don't necessarily have to spend a fortune to cure a problem or to improve your scores; what you do have to do is analyse exactly *why* you think something is going wrong and where the problem lies.

Changing distances with the standard modern .22 target rifle usually involves zeroing in on the sighter at each range before commencing the 'shots to count' on the match card. This is a fairly straightforward procedure which involves you adjusting the rearsight until the centre of your group coincides with the centre of the target. In a perfect world that would be that, and you'd go on to shoot a perfect score.

But very few of us shoot in a perfect world and there are all sorts of things on the range which are designed to make life more difficult for you: the wind, for instance.

Supposing your last card was shot at 50 metres and now you're about to shoot the second half of a Dewar match at 100 yards. If you're using the standard Anschutz rearsight, you'll have to raise it by something like 40 clicks (or 80 clicks on some of the latest ones). Those of you who've forgotten to do this will curse when your first shot goes into the white on the first scoring diagram.

You may also have to allow for some windage correction, depending on the degree of cant which you use. You may find yourself adding ten or more clicks of windage to get you close to the bull.

Top shooters probably find that they need do no more than that, and their first three or four shots are accurately centred on the bull, so the rest of their sighters can be used to gauge the wind strength and direction.

Lesser mortals find that the first three shots (and you should never assume your group is anywhere with less than three shots) are centred off to one side of the bull. You'll expend several more rounds working your way into the middle before you have enough confidence to know that your group is

central. (This could take a further three to six shots depending on how far you have to move the group).

By this time your sighter is beginning to resemble a colander and you're well into the time allowed for shooting your competition card.

If you're capable of despatching twenty shots accurately with machine-gun-like rapidity then you have no worries, and the time you spend on the sighter will enable you to shoot with confidence.

If, however, you're a slow steady shooter and you've spent quite some time on your sighter, you could find time running out on the match card itself, forcing you to rush your last shots, especially if you're waiting for a particular wind condition to return. So, there's a lot to be said for the ability to shoot fast, and time spent developing that skill will stand you in good stead.

Some of the comments made after coming off the firing point can be quite revealing about the way the shooter shoots. Comments like: "I fired fifteen shots at the sighter and didn't hit the bull once, so in the end I gave up and went down onto the match card because I was running out of time".

Time spent blasting away at the sighter in a desperate attempt to hit the bull is wasted. Your time on the sighter should be spent confirming that you're in the correct position and then working out the prevailing weather conditions.

If you find that your usual sight adjustments haven't brought you to the middle of the bull, it may be because you've got down in the wrong position, or the wind conditions are vastly different from the last time you shot.

Sorting out which of these conditions applies at the time takes experience and practice, but you should always ask yourself *why* your first shot wasn't a bull.

Don't forget that most rifles have a 'cold barrel shot', which may land quite a distance from the true centre of your group. In fact, some rifles may have two cold barrel shots where the first shot is in the '8' ring, the next is in the '9' ring and then the third is in the bull or where the bull should be.

Don't put your cold barrel shots on your target or sighter unless you're deliberately measuring where they go, or you're shooting an U.I.T. competition when they would count as misses. In U.I.T. competitions, *you* take a break when you feel like it, but you aren't allowed to take any more sighters or barrel warming shots once you've started the course of fire. That

means, if you stop shooting you may have to go back to a cold barrel, so it could be useful to know where *your* cold barrel shoots.

If you clean your rifle regularly, you may find that, after cleaning, it takes longer to settle down into its true group; unfortunately this can vary from rifle to rifle but you could find that you have to shoot twenty or so shots before it settles down.

It also varies depending on what you call 'a clean', as this can range from a thorough scrubbing, to just pushing a patch or cleaning felt down the barrel while it's still warm and the residue is soft, to remove the powder etc. which is left after firing.

Only *you* can work out your particular barrel characteristics and take the necessary action, but this is something that is certainly worth investigation if you wish to make best use of your sighting shots.

All these points can perhaps lead to you spending unnecessary time on your sighter, reducing the amount of time left for concentration and effort on your scoring diagrams, but there are several things you can do to reduce this.

Some rifles may have a zeroing device built into their rearsight, which enables you to move the adjustment knob independently of moving the sight.

This means that you can set a 'no wind' condition to both your elevation and windage knobs. When you come to shoot you can then estimate the amount of adjustment required depending on the conditions, and apply the relevant number of 'clicks' to your sight before firing the first shot on the sighter. This takes practice, but it saves you time and can build up your confidence enormously when you get it right.

Some of the older Anschutz sights have little plastic windage scales built in, but on the whole they're a bit too crude to enable you to judge the amount moved accurately.

If you have no zeroing device, you'll have to rely on a good memory to tell you what the conditions were like the last time you shot. Those of you with poor memories will find a shooting record invaluable here, as it should give you the wind direction and strength on the last occasion you shot.

If the wind is from a different direction, you may want to add or subtract from your windage adjustment when making elevation changes. Knowing how many clicks a wind is worth is an old fullbore trick, often neglected by

the smallbore shooter. A working knowledge of just how many clicks you're winding on or off relative to wind speed, can be an invaluable aid to your shooting.

When you're going from 50 to 100 yards, winding up 40 or 80 clicks is a long way and it could be very easy to lose count. Even more disastrously, you could wind them the wrong way and your first sighting shot would end up somewhere on the scoring rings (*Sod's Law* dictates that it won't be in the bull!)

Apart from the pitfalls mentioned above (and the extra time you might need to sort them out) all this winding up and down could accelerate the wear and tear on your rearsight, particularly if you allow it to get dusty and dirty.

However, there is an easier way to alter your sights for different distances, thereby saving yourself some sighting-in time - in fact there are several choices. Sadly, the first two are no longer in production, although you may find them available secondhand.

One of the first people who decided a long time ago that there was an alternative to all this winding up and down was John Kelly. He produced a foresight with a brilliantly innovative idea, i.e. by simply unlocking a ring on the back of his foresight you could turn it through 180 degrees and, by means of a cam arrangement, the foresight element was raised or lowered by the necessary amount, instead of having to raise or lower the rearsight.

In practice, to go from 50 metres to 100 yards you need to *lower* the foresight, but that information is not relevant in the case of John's invention, because it is clearly marked '50' and '100'.

It still doesn't take into account any windage adjustment, but that would be difficult to engineer, as each shooter cants to a different degree; there *is* a system which takes individual shooters' cants into account, but that will come shortly.

Another system which eliminates all that winding is the dual height foresight block. This replaces the normal block at the muzzle end with one which, as its name implies, is stepped. Once it's screwed into place it allows you to fit your existing foresight in two different positions at two different heights. It does mean that the sight radius will be altered very slightly each time you change distances, but it's by such a small amount that it should be barely noticeable.

This arrangement enables you to retain your original foresight, with all its accessories (adjustable iris, levelling bubble, anti-glare tube, etc.). It does, however, have to be made reasonably accurately because the height

difference is small, and is not the sort of thing which can be knocked up in a garden shed with a bit of old steel and a file.

Unfortunately, this system only suits Anschutz models with a dovetail mounting block on the end of the barrel as on the 1813 and earlier models (and derivatives).

None of the systems mentioned so far takes into account a shooter's individual cant and they all require some minor final adjustments on the sighting card before you can guarantee your group is central.

There is only one system that which will guarantee that your first shot will be a bull (providing, of course that you don't make a mistake and that you've adjusted correctly for the wind) and that is to use a different rearsight unit for each distance.

Experiments have been conducted to prove that putting a rearsight on and off a receiver every time does not interfere with the zero of the sights.

The experiment was conducted with the aid of a vice and a dial gauge; the rearsight was taken on and off 50 times and at no time was the sight more than one thou. off-centre, which is less than one click.

So, with absolute total confidence you can put a rearsight on your rifle (making sure that you get the correct one for the appropriate distance, of course) and know that if your first shot on the sighter isn't a bull - after firing any warming shots - something is wrong.

This is an expensive option, particularly if you wish to duplicate complete set-ups with irises, filters, anti-glare tubes, etc., but secondhand rearsights occasionally appear on the market and if they're a different style to your original one, that's not really too important. Even if you have two rearsights which move a different distance per click, this alters over the various ranges anyway, and is something you would get used to very quickly.

In dramatically different wind conditions it's so much easier to calculate how many clicks of windage you need before starting on your sighter if you know that your sight is zeroed in at one particular distance. You don't actually have to duplicate your iris and filter sets unless you want to, because taking them in and out each time you change ranges is not a major headache.

The hard plastic rifle-carrying cases which are in use nowadays make carrying spare sets of sights much easier, or some shooters use purpose-made sight boxes, or even foam-lined small pistol cases which are very cheap and which take all the delicate bits and pieces shooters seem to

collect.

One thing to bear in mind when considering the various alternatives is that, when you wind your rearsight up from 50 to 100 yards, or if you use different rearsights for each distance, you are in fact raising the aperture you look through by about 1/16". Although it doesn't seem much, it can alter the pressure your cheek exerts on the stock.

If you have a rifle with an adjustable cheekpiece you should (in theory) raise it by this amount each time you go from 50 to 100 yards (and, of course, lower it when you come back down). If you don't have an adjustable cheekpiece, there's not much you can do about it, and you would probably be better off trying to find one of the secondhand alternatives, which involve the foresight in some way, so that head position and cheekpiece pressure remain consistent.

It doesn't matter which of the above systems appeals to you most - they will all save you time on your sighter, and that time can be well spent analysing the conditions on the range.

It's important to spend as much time as you can on your sighter, but what you don't want to do, particularly in difficult weather conditions, is waste it on making adjustments which you could have sorted out before you even fire your first shot; investing in one of these systems can certainly give you more time where it's needed.

CHAPTER 12

SIGHT ACCESSORIES

After looking at rearsights themselves, now it's time to examine all the goodies that you can add on to them to improve your sight picture.

A brief look at the market reveals that there are a thousand-and-one things which you could screw into your rearsight, the question is: which ones are going to do you any good?

Looking through a pinhole should be sufficient to give you a good sight picture, but those of you with tired old eyes are at a disadvantage, and anyone who shoots outdoors may need something to combat the ever-changing light conditions.

So is there anything you can do to give you some form of adjustment to the pinhole which would assist your eyesight *and* cope with the changes in light?

You could increase or decrease the size of the pinhole aperture - just like the iris in your eyes; that changes for a variety of reasons, but it does so primarily to accommodate changes in light levels.

Of course, your eyes work automatically, but if you're looking for something that can be adjusted when you need assistance, it's reasonable to assume that, as the light level goes down so you need to increase the size of the aperture to let in more light.

Unfortunately life is never that straightforward, and increasing or decreasing the size of a pinhole does more than alter the amount of light reaching your eye: it will also change the depth of focus, or the range over which your eye will focus. A smaller aperture increases the depth of focus and a larger one decreases it, just like the aperture in a camera.

Many years ago *Parker-Hale* brought out a wonderful little gadget which consisted of a normal eyepiece with a disc inside containing six different-sized holes arranged in a circle, so you could click each hole around into the sight line.

These are still in use today, but have rather been superseded by the continental system of having an adjustable iris, similar to that found in a camera.

This has an advantage over the six-hole eyepiece in that it can't get out of alignment while adjustments are being made, whereas if you don't turn the *Parker-Hale* disc quite far enough you could end up with your sights being misaligned. This isn't a problem if you have time to sight in again, but could be disastrous if you're halfway through a match card.

The standard rearsight aperture sold with most European rifles is 1.1mm; that precise size has not been chosen at random, it's the result of numerous experiments to determine the best all-round aperture to produce the smallest groups.

So, why should you need to alter this size at all?

Well, as mentioned earlier, you know that the sights actually act as an optical instrument; if you're sceptical about this, try looking at the target and ringing it with the foresight without using the rearsight, and see what sort of sight picture you get. You'll find that you see it much better when the rearsight aperture is included in the combination.

Now, supposing that you've had a hard day at the office but there are indoor league cards to be shot that night. You may start off OK but gradually you notice the sight picture starting to deteriorate and you're struggling to focus. Then 'nines' start creeping onto the card and before you know where you are you've had a disaster, produced a rotten score, and you go home wishing you hadn't bothered.

How did that night differ from other nights when you had a good shoot? It could have been because your eyes were tired as a result of excessive paperwork, looking at a computer screen all day, poor office lighting or even sheer physical exhaustion. It's an old (but true) saying - "if you can't see it you can't hit it".

The first things to suffer when you get tired are your eyes. Muscles operate the lens in your eyes, so if you've been working those muscles hard all day, they'll be tired by the time you come to shoot in the evening. Then you ask your eye to focus on something four feet away, i.e. your foresight, when it would much rather focus on the target 25 yards away because that's easier.

As a consequence, your eye hunts up and down between the target and foresight, without really focussing on either, and then the sight picture begins to deteriorate.

It's also possible that you may have a problem with your eyesight which manifests itself when you shoot, but goes unnoticed in your normal everyday life. Eyesight problems and their correction will be discussed in a separate chapter, but just for the moment, let's assume that your eyesight is basically sound.

So, what you need is something to help your eye focus on what you want it to - the foresight - and this is where an adjustable iris in the rearsight might help.

If you're shooting indoors, you may have dim range lighting, but it's not going to vary from week to week, so you're unlikely to need to adjust your iris for changing light conditions. Where you're more likely to gain benefit is having the ability to adjust the depth of focus slightly by altering the size of the aperture.

The modern adjustable irises usually have an adjustment range from about 0.8mm to 2.00mm; as you reduce the size so the picture gets darker but the depth of focus increases, and this may be sufficient to help your eyes focus on the all-important foresight.

Too small an aperture may distort the picture because of light refraction around the edge of the hole, so anything less than 0.8mm could have a disastrous effect on your average. By the same token, it's vital that you only look through the centre of the iris because of the distortion in the sight picture at the edge of the hole.

One thing to remember with an adjustable iris is that you need a size to use as your bench mark, i.e. start with 1.1mm, go up or down as necessary, and re-set it back to the 1.1mm when you've finished your evening's shooting. Otherwise you may be continuously trying to reduce the size and eventually run out of adjustment.

It is unlikely that you'll need to adjust the size of an iris much outside the range of 0.9mm to 1.3mm and the actual adjustments are likely to be very small; if you need an aperture bigger than 1.3mm to see the target clearly, there's a possibility that there's not enough light available in your range.

Adjustable irises are extremely delicate instruments; they work by moving a series of interconnecting leaves arranged in a circle. Consequently they're prone to damage by neglect and the intrusion of dust and dirt, but even worse is the damage caused by ham-fisted cleaning, so be careful! Try looking in camera shops for sight-cleaning equipment - anything used to clean something as delicate as a camera should be all right on your sights.

The next things to consider are filters, i.e. those little bits of coloured glass that some people use within their sighting system in the hope that it will improve their sight picture.

The big question is, of course: "why use a filter at all?" There are several answers to that question.



Adjustable iris and coloured filters

Firstly, a filter can improve the contrast on the target and make it easier on the eye.

Secondly, it can cut down the glare from a brightly-lit target, either caused by sunlight or by indoor target lighting.

Thirdly, on a dull day outdoors a yellow filter can appear to brighten things up.

Fourthly, it's something else to twiddle.

So let's look at the first reason in more detail: there's an old saying that "any filter is better than no filter", but which one actually suits you best is a matter of personal preference.

Some colours are recommended over others, and the one which should be put at the top of your list is yellow. The reason for this is that the human eye is at its most efficient at the exact wavelength of yellow light, so by using a yellow filter you are actually helping your eye. This may also help to explain why a yellow filter appears to brighten things up a bit.

No particular filter will actually *increase* the amount of available light, because you lose a percentage of the light reaching the eye at every glass-to-air surface. The amount lost is between 3% and 4% and it is cumulative, i.e. at the first surface only 97% of light gets through, then at the next surface 97% of *that* light gets through, and so on.

So, most filters are designed to be used when the light is too bright, which all seems fairly logical and explains the second reason for having a filter.

As most outdoor smallbore ranges in this country face north, most outdoor shooters are going to have the sun behind them; consequently, there may be considerable glare from the white of a target card. This is where a grey filter could come in handy as it will cut down the glare and improve the contrast on the target.

There are other colours which could be used: a lot of people often used a brown filter and some people like a green one but the colours to be *avoided* are blue and red.

The reason for this is that blue filters don't reduce any of the ultra-violet light rays which emanate from the spectrum and red filters don't reduce any of the infra red light rays. As they reach the eye these particular rays contribute to a blurring of the image on the retina.

The neutral browns, greens and yellows in the middle of the spectrum absorb *all* the infra red and ultra-violet rays and, although grey filters don't actually absorb any of these rays, they do at least reduce the overall glare back from the target in bright sunlight and so are well worth keeping in mind.

Therefore, if you're choosing a filter set to screw into your rearsight, go for two different shades of grey - one for bright sunny days and one for extremely bright sunny days - then a yellow for dull, cloudy days, with a brown and possibly a green just for a change.

When things occasionally seem to be drifting into mediocrity during a shoot, a change of filter can sharpen things up; at least if you have a combination of colours you have the chance to choose a sight picture which suits you on that particular occasion.

All of which, of course, brings me to the fourth reason for having a filter. It isn't 'just something to fiddle with', it's being able to cope with all the changes in light which you're likely to encounter shooting outdoors.

If you only shoot indoors on the same range all the time, rather than going for an expensive variable filter set, you could go for a single colour filter glass which would fit into a rubber eyecup.

Up till now we have only considered the basic adjustable iris and filters but there are many more things you can add to your rearsight.

Those of you who were once boy scouts probably remember the motto "be prepared" and the one thing the average British rifle shooter needs to be prepared for is the British weather.

The climate in this country involves a great deal of light changes as well as atmospheric conditions, and anything which you can add to your sights to help you cope with these changes must be an advantage.

Be warned though, it's very tempting to adorn your rifle with all sorts of goodies until it looks like some sort of metallic Christmas tree, particularly when the manufacturers keep bringing out new gadgets to play with.

But are any of them any good? No manufacturer is going to produce goods which nobody wants, and sharp manufacturers listen to what the shooters want, so if a particular accessory is being made by a large manufacturer, there must be a demand. No large company is going to invest money in a product which won't sell, so if a product is on the market, somebody somewhere wants it, and perhaps you do too.

The first gadget to spring to mind is a polarising filter which can be added to, or used instead of, the colour filters. Most people are familiar with *Polaroid* sunglasses and are aware of the way in which they cut down on the glare, so anyone who's bothered by light glaring through their sights, must be attracted by the idea of a polarising filter.



Iris, coloured filters and a polarisation filter

Most of the polarising filters that are available for rearsights are adjustable, i.e. the amount of light they let through can be varied. They usually consist of two circular or semi-circular polarised filters - one behind the other - one of which (or sometimes both of which) may have a lever attached so that they can be turned independently of each other. Turning one at 90 degrees to the other will considerably darken or brighten the image.

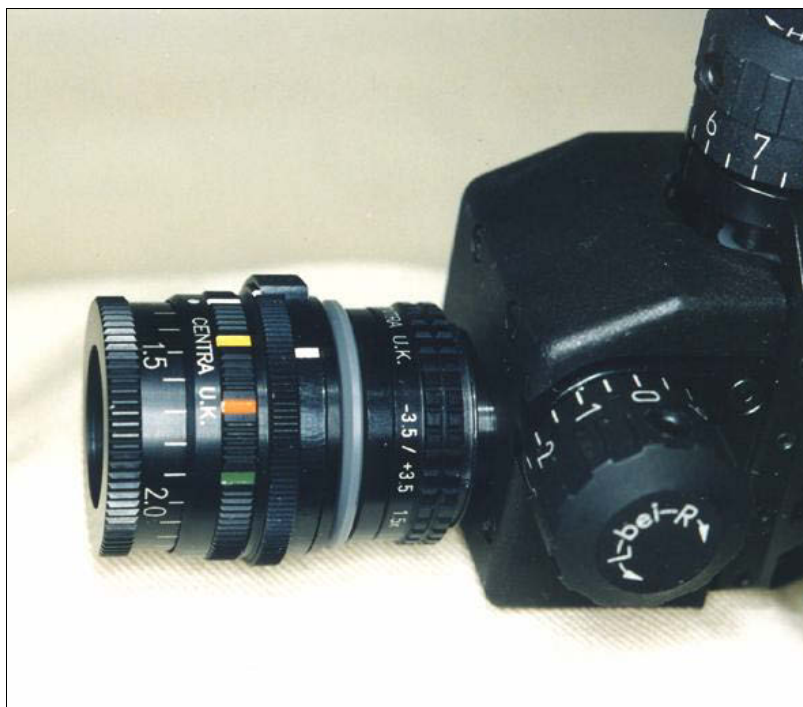
If you use this type of filter with a normal 5-colour filter set, it will give you an infinitely variable choice of polarised colours, which should be more than enough to cope with any light combinations that Mother Nature can throw at you.

There's no substitute for having perfect eyesight, but for those people who fall short of this ideal, then there are attachments which *may* help; in particular there's a device marketed by *Centra*, *Gehmann*, and possibly other manufacturers, which is a magnifying diopter.

This comes as part of some of their filter and iris sets, and magnifies the sight picture by up to one-and-a-half times. That in itself is a help, but what it also does is enable you to change the focus, which can be an enormous advantage when it comes to trying to get your eye to focus on the foresight.

However, one thing it doesn't do is correct any eye defects, so you'll need to get your eyes checked first, but if you do have difficulty with your eye hunting up and down the range between the target and your foresight, you might find this gadget an advantage.

Under N.S.R.A. rules a 1.5x magnifying diopter is allowed, so you need have no fear of being accused of cheating, and because the target is enlarged 1.5 times, it will appear to be only 70 yards away instead of 100 and will therefore seem much bigger. How can you miss?



Iris, coloured filters, polariser and magnifying diopter

It should be borne in mind, however, that a magnifying diopter is *not* permitted under the U.I.T. rules, but, as mentioned earlier, these are for international competitions and don't affect the majority of club shooters.

Before you dash off down to your local gun shop for this magic, point-winning piece of equipment, be warned that, in shooting you never get something for nothing. If using this piece of kit guaranteed an improvement, everybody would be using one, but they're not, so there are possible problems to consider.

Lots of people have tried these diopters but not everybody finds them beneficial. That could be because, in order to magnify and adjust the focus, you need two lenses, and they have to be curved, so there's a risk that light could reach the eye from somewhere else other than through the exact centre of the lens, which could lead to distortion. This means that careless head placement can result in an '8'.

You have to be prepared for some losses to offset the benefits of using these multi-filter and lens sets, and the main disadvantage arises from the fact that, the more glass you put between your eye and the target, the more the light struggles to get through, and the more it could get diverted from its true path.

Luckily the losses are small in relation to the gains, but you must be prepared to keep all lenses and filters clean; you can't afford to allow even a small speck of dust to rest on your lens as this may distort your sight picture.

A word of warning, however, about throwing your filter sets into the washing machine - they don't like it!

Despite the *Centra* and *Gehmann* design features which tend to keep the innards of these filter sets, etc. clean, you may find after several years that they require some serious cleaning. If you *must* take one apart yourself, do so with extreme care.

The filters inside are very small and are loose in their recesses, so they delight in dropping to the floor and burying themselves in the carpet. The sets also contain a series of cogs and wheels which have to be disassembled and re-assembled in the correct order. You have been warned!

However, if you don't feel confident about tackling the job yourself, the manufacturers will completely overhaul and service any of their sights at a reasonable cost (compared with the cost of a new sight). Any good target shooting shop should be able to send it off for you, or you can contact the manufacturers direct.

You may feel that, to achieve the ultimate in versatility you want to fit all these goodies to your rearsight; by all means try them, but you could find that the increase in length reduces your eye relief considerably, and moving your rearsight far enough forward to compensate for this could interfere with the loading port on your rifle.

However, don't despair, you can shorten the clamping bars of the sight with the careful use of a hacksaw; in fact you actually only need one clamping screw on a typical *Anschutz* rearsight (the *Walther* rearsight only has one anyway). It's far better to have the right filter combination and eye relief than to worry about losing a clamping screw.

Some people find it necessary to fit anti-glare tubes to their rearsights, and if you find you're having a problem with too much extraneous light coming through the aperture, you'll find an anti-glare tube will help.

The idea is to fit a tube to the front of the rearsight so that only light from directly in front of the rifle reaches the eye. Most tubes are usually fairly small (approx. 18mm diameter) and have a rough or corrugated surface inside to stop any light being reflected off the inside of the tube.

Some anti-glare tubes have become quite sophisticated now, instead of just being a plain tube; *Gehmann*, for example, have produced a couple of tubes with novel features.

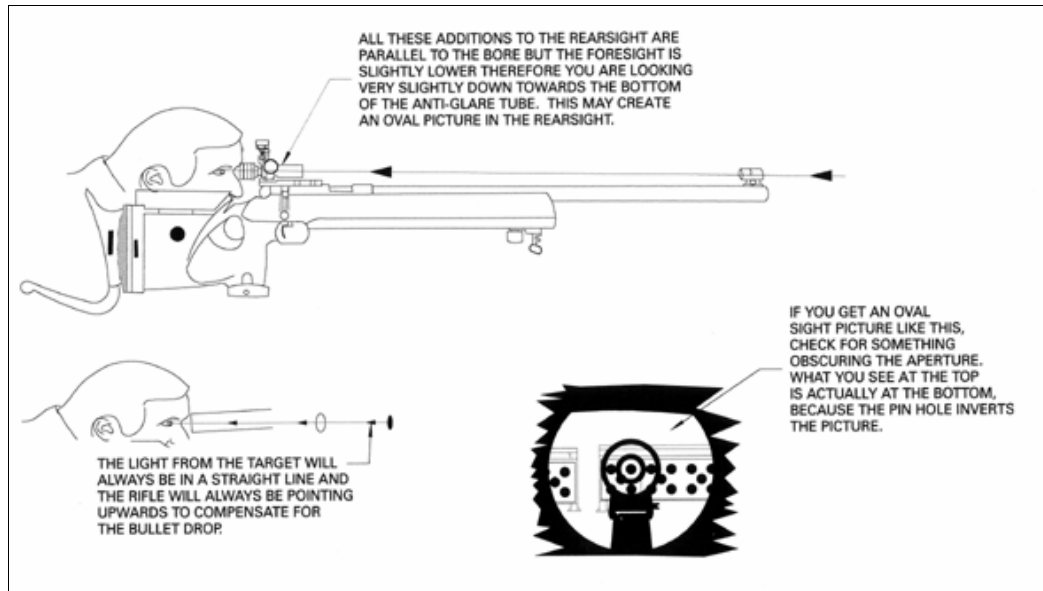
One has a built-in polarising filter, the other has an adjustable iris at the front end which is not intended to replace the iris in the rearsight, but is designed to cut down even more light. In fact, you can shut it down far enough to exclude any light, other than that coming from the target.

However, these anti-glare tubes do *not* turn your rearsight into a tube sight. The difference is that a tube sight is hinged at the front end, so as you raise the rearsight the front of the tube stays where it is. The latest *Walther* rearsight is, in fact, a tube sight, whereas the latest *Anschutz* model is a standard sight with an integral anti-glare tube.

A note of warning: adding all these tubes and things *may* interfere with your sight picture.

Firstly, it's fairly obvious that the centre of the foresight must be nearer the centre of the barrel than the rearsight, otherwise your bullets wouldn't reach 100 yards. Therefore when you look through your rearsight at the foresight, you're looking downhill very slightly.

If you're looking through a long tube at something which isn't exactly on the same centreline, it's possible for the bottom of the tube to interfere with your sight picture, and you may get an oval aperture.



Too much of a good thing

If you prefer to shoot with everything symmetrical, having an egg-shaped rear aperture is not going to be your cup of tea, but whether or not you get this effect does depend to a certain extent on the eye relief you prefer. If you shoot with a very short eye relief, obviously you have a greater field of view and this is when you may get interference.

If you've fitted an iris and filter set with a magnifying diopter at the back of your rearsight, and an anti-glare tube at the front, all that equipment is parallel to the centreline of the bore. The iris is usually the part nearest to the eye, so it's possible for the bottom of the front anti-glare tube to interfere with the sight picture.

Don't panic! Providing the anti-glare tube isn't too small, and the sights aren't bent the wrong way, most people won't be affected and, obviously, if the problem is going to occur it will be when the sights are set at 100 yards, i.e. at their highest.

Some people, rather than give up any of their accoutrements or change their eye relief, have actually bent their rearsight so that it leans forward very slightly to counteract the problem.

Some people have shot with an egg-shaped rear aperture without realising it, simply assuming that it was normal and that everybody else did it as well.

Because we're all individuals who see things differently, there's no such thing as a set of exact specifications laying out what we must see in order to get a perfect score, and sometimes we have the ability to shoot a good score with a less than perfect sight picture. This is what makes rifle shooting so exciting and challenging.

Don't be afraid to try some or all of these accessories; they're not produced without a great deal of thought, and there might just be something on the market that helps you cure a problem you didn't know you had.

There's always the possibility that by experimenting you'll hit upon the right combination for you, so don't ever accept that you're shooting as well as you're able - there's always something which could improve your score, all *you* have to do is find it.

CHAPTER 13

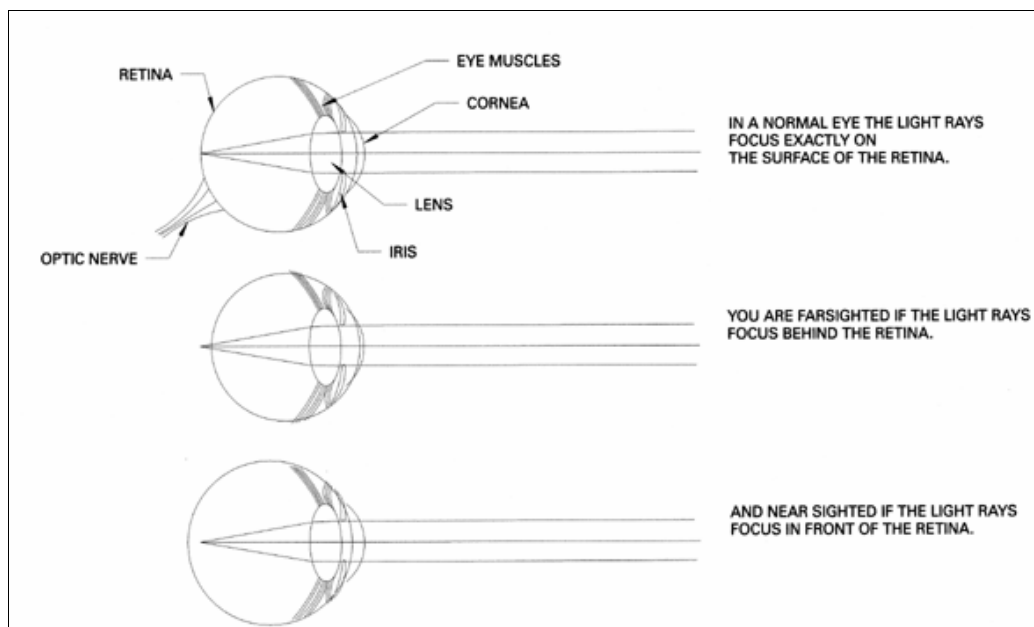
EYESIGHT AND SHOOTING GLASSES

Now is the time to turn your attention to a much-neglected part of the human anatomy - a part on which we, as shooters, rely heavily: the eyes.

People often ask if good eyesight is necessary to make a good shot. The standard stock answer is “no”, because defective eyesight can be corrected, within reason. But, like all standard replies, it only partly answers the question.

Yes, some shooters with poor eyesight *have* shot extremely well; on the other hand, some good shooters could have shot better had they not assumed they had perfect eyesight.

Information on exactly how the eye works is readily available in your local library - what is more important is how the working of the eye affects your shooting, so let's look at a few common eye defects which can all be corrected:



Very few people have perfect eyesight

First of all, a certain percentage of the population suffers from myopia (short-sightedness); these people mostly wear glasses all the time and are obviously very aware of the shortcomings of their eyesight, as well as being used to opticians testing their eyes at regular intervals. For this reason they're unlikely to be caught out if their eyesight suddenly changes.

Myopia is caused by the lens in the eye being the wrong cross-sectional shape and therefore focussing the light rays from distant objects at a point in front of the retina, instead of exactly on it. If that sort of defect can be corrected easily for everyday life, then it's not difficult to obtain a shooting lens to correct the problem for shooting.

A more difficult defect to overcome is presbyopia, or long-sightedness. This is more of a problem because it tends to arrive as you get older and you start to lose your accommodation (i.e. the focal length which your eye can accommodate).

Gradually you lose the ability to focus on things at the end of your nose and you start holding newspapers at arm's length, until you find you have to hold the newspaper so far away that the print is too small to read anyway. You suddenly find that it's easier to read somebody else's newspaper on the train than your own.

The main reason this condition causes the most problems is because it's such a gradual change that most people don't become aware of it until years after it's started. If you can't read a page at the end of your nose, you instinctively hold it further away, and it may be some time before you discover that your arms are too short.

You may be wondering why this should create a problem in shooting when your foresight is obviously not at the end of your nose. Well, in order to focus on something very close, you have to stretch the lens in the front of your eyeball; that takes muscle power and as you get older you lose some of that power, so it becomes more difficult to pull your focus back to close objects.

When you're looking down the 'tunnel' created by your aperture sight system, the foresight becomes a 'close' object when compared with the target (which could be 100 yards away).

In recent years opticians in the U.K. have had to release the stranglehold they had on eyesight testing and spectacle supply and, as a result, many other outlets have sprung up, supplying glasses 'off the shelf'. However, if you're suffering from any form of presbyopia, grabbing a pair of glasses off a stand and handing over your money just because you can now read the small print is *not* the way to go about correcting your vision for shooting purposes.

Do talk to other club members who wear a shooting lens as they will probably have personal experiences to relate, which will help you choose a suitable optician, or any specialist target shooting shop may be able to recommend someone. It's probably worth trying to find an optician who knows something about sighting problems related to shooting, even if you have to travel a few extra miles to see him.

Once the optician has tested your eyes he'll have to prepare a prescription, so now is the time to tell him what you're going to be doing with any lens he recommends, i.e. you need to focus on the foresight. You *don't* need a normal everyday prescription when it comes to shooting - what you need is a lens with a focal length of 4-5 ft., i.e. just in front of the foresight (reading glasses have a focal length of about 1 ft).

It would also be worth asking for an anti-reflective coating, because more and more ranges are using fluorescent lights these days, so being able to cut out any overhead reflection would be well worth the extra cost.

Your eyesight may be fine and not need correcting under normal circumstances, but it's still possible that a very small amount of correction could just relieve some of the strain after a hard day's work; anything that makes it easier for the eye to focus on the foresight will be less of a strain and will therefore help your shooting. But do discuss this with your optician - there's no point in having a shooting lens just for the sake of it.

You may consider that you have perfect eyesight, and your optician may even have told you that, but - and it's a big 'but' - there still may be room for improvement.

When you go shooting in the evening, how many of you spend the day resting your eyes? Not many, unless you have a job you can do with your eyes closed. And how many of you actually do any eye exercises?

Your eyes are operated by muscles, and even without moving your eyes, changing focus requires muscular effort. Try holding your finger up in front of an object at the far end of the room; now focus on your finger, then on the object, then back to your finger again.

You can probably feel your eyes changing focus and moving slightly; that requires muscular effort and you're doing that unconsciously all day every day, so sometimes these muscles get tired - just like any other muscles; then, after a hard day's work, you make their job even more difficult by getting down behind a rifle and only using one eye.

If you were to cover up one eye while your finger was held in front of the object, you would probably find that it takes slightly longer and is a little bit more difficult to focus on your finger. That's because you've cancelled out your binocular vision, which helps with distance and gives a three-dimensional view of everything.

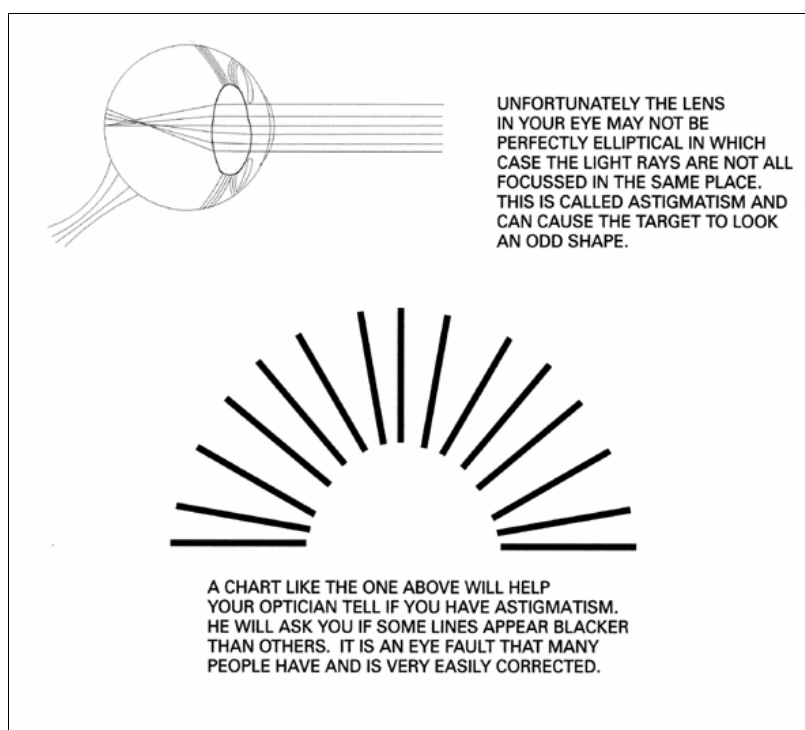
Looking through the sights of a rifle you have no 3-D effect: everything *looks* one-dimensional, but your brain interprets it as normal.

Therefore, is it any wonder that when you look down a tunnel with one eye the only thing your eye wants to look at is the target at the end of the tunnel, because that means that the eye doesn't have to do anything, it can just relax.

However, you don't actually *want* your eye to look at the target, and this is where a visit to a good optician is essential.

The problems which have been mentioned so far involve the lens being generally too fat or too thin, but now there's another problem to consider: this occurs when the lens is not perfectly round, which means that light coming through it isn't all focussed at the same point; this defect is known as astigmatism.

Opticians have a very simple test for determining whether either of your eyes is astigmatic, which usually involves asking you which lines are clearer in a semi-circle of parallel lines.



It's essential for shooters to have regular check-ups with their optician

If you look at the sketch with one eye, you may find some parts of the circle are clearer than others; this could be an indication of the presence of astigmatism, but this is *not* a true test and you should consult an optician if you feel you might have a problem.

Obviously, astigmatism is no great handicap in normal life - in fact some people suffer from it for years without even realising it - but to a shooter, anything which could be causing a blurring of the image, even in part, is to be avoided, so *get your eyes checked!*

The most important thing to bear in mind, however, is that the lens in front of your aiming eye must be presented such that the line of sight from the target to your eye runs through the centre of, and is perpendicular to, the lens. That's particularly difficult to do with the sort of frames used for reading glasses, etc. so you'll also have to give consideration to specialist shooting frames. Some opticians may be able to help you there, but most will look at you blankly.

However once you have your prescription, any optician can get a lens made to suit any frame or lens holder you choose, so it's up to you to see what appeals to you and then get your lens made up to suit. If you suffer from astigmatism, it's important that the optician actually fits the lens, because it will be marked to locate which way it must be fitted.

Knobloch frames come in two formats, the prone rifle - having a longer nosepiece; they also offer a choice of lens holder sizes - 38mm or 24mm and the 24mm is available with a straight stem, or a bent stem to bring the lens nearer to the eye. *Gehmann* frames only have the smaller-sized lens holder (angled in towards the eye) but they are adjustable for width and the nosepiece is adjustable for height, so it can be varied to suit prone or standing shooting. *Champion* frames are available in three different styles, with different degrees of adjustability and a choice of lens holder configurations.

Knobloch and *Gehmann* should be available from specialist shooting shops, whereas *Champion* frames are available through opticians as well.

Having got your lens, the next step is to go to the club with all your kit because, as mentioned earlier, the important thing is to present the lens in front of the eye in the right way. That can only be done in the shooting position, so a certain amount of fiddling will be required to adjust the frames properly.

Firstly the hooks which go behind the ear may need altering to ensure that they don't dig into you - excruciating pain while you're shooting does nothing for your concentration. They can usually be adjusted by careful manipulation.

Next, the lens holder has adjustments to allow it to be moved up or down, swivelled round or moved sideways along the frame. Set the lens approximately in place, but don't tighten the adjusting screw too much, then get down in position behind your rifle (this could be done in the clubroom - you don't have to be on the firing point).

When you look through the sights you should be able to see the lens circumference in your peripheral vision. Now you should be able to move the lens holder manually, to locate the outer ring around the rearsight and to add another concentric ring to your sight picture. Take care, however, that you're only actually moving the lens holder and not the whole frame.



Get those frames in the right place

The frame should fit well enough so that it always locates in the same place and will not easily move out of position. If you have difficulty making this adjustment, ask a fellow shooter to do it for you.

Having located the lens holder in the right position, you now have to ensure that it's perpendicular to the sight line. One way of doing this is to get someone else to look at the lens from directly above you (it's easier if you're not wearing a shooting hat), and then look at you from the side.

Another way (if you're trying to adjust it on your own) is to twiddle the lens holder round manually while you're behind the sights; because the sights are black, light will be reflected from the glass of the lens, and it's just possible that, in the right light conditions, you may be able to see your own eyeball. If you can, then the lens will be square to your eye. Remember to lock all the screws in place when you've completed your adjustments.

Having read about the various types of shooting frame available you will have guessed that these represent quite an expensive investment, particularly if you don't know whether a lens is going to help you at all. In that case you'll be pleased to know that there is a cheaper alternative.



Lens holders need not be expensive

This is basically a single plastic lens holder hinged to a plastic pad, which can be sewn onto a sweatband, or you can thread a piece of elastic through it, to hold it on your head. The hinge enables you to lift it up out of the way when you go to change targets (which might stop you falling into a ditch at Bisley). However, make sure that it's protected when you shoot in the rain - water on lenses does not produce a good sight picture!

It's an extremely simple and effective idea and it suits left- or right-eyed shooters because the stem of the lensholder can be warmed up (in hot water or with a hair dryer) and twisted to the correct angle.

You can set it to the correct position in front of your eye each time you shoot, by simply pushing it into the right place with your fingers. Like most simple ideas it's easy to use, very effective and reasonably-priced - about a quarter of the cost of a set of frames.

Now you're ready to take on the world, but remember that you've added another piece of equipment to your collection, which means something else to look after and maintain.

Don't neglect your lens: if it's dirty it will interfere with your eyesight. Clean the lens every time you shoot, then it becomes part of your routine while you're getting ready. Don't just use any old piece of rag or the bottom of your shooting sweatshirt - opticians sell special cleaning tissues and cloths, which won't damage your lens.

You may have noticed, while looking at the different frames, that there's a variety of accessories available, so while you may not want to add to the cost at the time, there may be things which you could add to your birthday present list.



Attachments by the score

For example, an eye blinder (usually available in black or white or grey), side shields (also black or white or grey), or a spare lensholder for the non aiming eye to enable you to see wind flags or to use the spotting scope more easily; filters are even available, and the *Knobloch* system also offers a set of opaque filters for the non-aiming eye so that both eyes are seeing the same colour.

If you already wear glasses for everyday use, you could continue to do so (providing you can actually focus on the foresight with them), but you must remember that, when you're shooting prone you're looking out of the top of your eye. Therefore, in order to get the middle of the lens in front of the eye you'll need to pack up the nose piece with some suitable material (like a piece of cork, or *Blu-tak*) to lift the frames up high on your nose; otherwise it's highly likely that the edge of your lens will severely distort the sight picture.

There is another way of getting a prescription lens into your sight line and that is to fix it into the actual rearsight itself; this would fall foul of the UIT regulations, but not the NSRA rules.

However, this seems to be a system which has lost its popularity in recent years, probably because nobody actually commercially produces a holder, and more and more people are using screw-in irises, filters, etc., which don't leave room for a lens. However, there's nothing to stop you devising your own system if you prefer to attach the lens to the rifle rather than to yourself.

One important question, of course, is how do you decide whether a visit to an optician might be beneficial in the first place?

The problem here is that everybody's eyesight is different and none of us sees the same thing in the same way. Next time you're down the club, try comparing eyesight between members. Everyone's visual acuity varies tremendously, and just because one person can read a typed notice at ten feet it doesn't necessarily mean that he will shoot better than somebody who can't.

It's also not unusual for somebody to borrow somebody else's rifle, only to find that it shoots in a totally different place. Of course, a certain proportion of that can be down to hold, but it is also down to eyesight.

So, the answer is, in my opinion, if you take your shooting seriously it would be well worth you investing in an eye test, even if you have no particular difficulties in everyday life, as shooting makes such great demands on your eyesight.

Remember: muscles work your eyes, and every time you look up from this page your eyes will automatically focus on the next thing you look at - that's achieved by the muscles changing the shape of the eye. Your eye relaxes those muscles when you look at more distant objects, so it's more of a strain on those muscles when you look at close objects.

Try to relate your shooting to what you were doing all day. If you find difficulty in focussing, or getting a decent sight picture, it may be connected with what you were doing earlier on.

If your work involves a lot of paperwork, your eyes will spend all day straining to hold focus at short distances, whereas if you work outdoors your eyes could spend most of the day in a fairly relaxed state. Obviously it would be difficult to tell your boss you can't do any paperwork because you're going shooting, but at least if you're aware of the problem you might be able to rearrange your workload, to protect your eyesight as much as possible.

Your eyes have one other particular enemy in an office - computer screens (VDUs), so if you use a computer, try to reduce the amount of work you do on it if you're shooting later in the day.

There are other things which affect your eyesight, of course, like having a cold or the 'flu, suffering from hay fever, or working in a dusty environment. All of these can make your eyes sore and watery, which won't help your concentration and all of which can help to explain why a disastrous shoot may suddenly occur.

Most of you know when you've got into the wrong position and ended up fighting the rifle, or when you've yanked on the trigger, but your eyes can play tricks on you without you really realising; at least you now perhaps have some idea where problems might arise, so you can look out for them and avoid them where possible.

Another phenomenon which occurs with a lot of people, is very difficult to put a name to.

Basically what happens is that small out-of-focus particles appear to float up and down in the eyeball - in fact some people refer to them as 'floaters' although that's probably not the correct technical term. Generally what happens is that they float down past the aiming mark and foresight while you're concentrating on the sight picture. Sometimes they're not there or are barely noticeable, other times they are a wretched nuisance.

They are actually bits of redundant eye cell floating around in the liquid in the eyeball (you may not have wished to know that!) and some people have more than others. They don't in fact do any harm (except interfere with your sight picture), which is perhaps just as well as there's no known cure, but blinking or looking away can often help.

There are many other eye defects which we won't go into here, but if you suspect that there may be something wrong with your eyes, consult an expert.



A seeing system

At this juncture it's important to analyse why it's better to focus on the foresight rather than on the target, although undoubtedly there are many people quite happily shooting with a fuzzy foresight and a clear target and *they*, of course, don't have to strain to focus on something close to them; they may even be putting up brilliant scores and be very happy with that.

However, for the majority of shooters, a sharp clear foresight is vital because - and this is most important - errors in shooting are angular, and what may seem insignificant at the rifle end can result in a massive deviation on the target. The error can be multiplied in direct proportion to the distance away from the target.

Another interesting fact to tuck away at the back of your mind is that every click of a standard *Anschutz* sight produces a movement in impact on a target at 50 metres, 65 times greater than the movement of the rearsight.

What this is leading up to is that, if the foresight is fuzzy, its edge is indistinct and misplacement of the foresight could occur because of difficulty in judging the evenness of the white surrounding the aiming mark. That misplacement is multiplied in proportion to the distance to the target. However, when the target is blurred and fuzzy, the edge may be indistinct, but it's still possible to take an accurate central hold.

For those of you still unsure about what should be in focus, here's the formula for why it's important to have the foresight in focus and not the target.

First you have to remember that everything in rifle shooting is cone-shaped. That explains why a 100-yard card is bigger than a 25-yard card and the organisers of competitions (usually the NSRA in this country) know that the further away a target is, the more difficult it is to hit. Before you all start groaning and complaining that is stating the obvious, stop for a moment and think about what you've just read.

Why is everything cone-shaped? Certainly the aiming mark has to be bigger at 100 yards otherwise we couldn't see it, let alone shoot at it. (Have you ever tried shooting at a 25-yard target set at 100 yards? It's great fun, but extremely difficult). However, while the aiming mark *has* to be bigger, the bull doesn't, but it is!

That's because the competition organisers know that your rifle and ammunition produce a group which is bigger than one .22 hole, so your shots must conform to a cone-shape, albeit slightly bent because of trajectory, but let's not complicate matters too much at this stage.

The point of the cone is your muzzle, and the base of the cone is the circle formed by your shots on the target at 100 yards (i.e. your group); so, the bull *should* be exactly *pro rata* in size to the distance from the muzzle. However, it isn't - it's bigger.

Does that make a 100-yard target easier to shoot? No chance! There are other cones at work here. It would be nice to be able to say that the organisers are so clever that they've built in an allowance for the weather, but how many shooters are there who can always guarantee to shoot perfect scores indoors! There aren't many, are there?

So what else happens? *You* happen. *You* are responsible for enlarging the cone shape. The target size is based on what people can hit - as soon as too many people start hitting perfect scores all the time, the organisers reduce the size of the target. Of course, focussing on the foresight is made doubly difficult because right in the middle is something on which the eye would much rather focus, so how do you fix your focus at the foresight?

What happens is that you make a mistake, which is magnified by the distance to the target, because your rifle is fixed in your shoulder and any error causes your muzzle to describe a circle larger than the movement in your shoulder; this continues to expand all the way to the target.

So, having got that idea firmly fixed in your mind, let's turn our attention back to your eyesight. If your foresight is blurred, it means that you can't define exactly where the edge is, and that blurriness may extend to perhaps a millimetre.

Let's, for the sake of easy mathematics, assume that your sight radius (the distance from your foresight to the rearsight) and the area at the tip of the cone is approximately one metre; that means that any error is going to be 100 times bigger on the target.

That means that blurriness of *the foresight* is hiding an extra 100 millimetres (or four inches) of the target. With a small foresight (and consequently little white around the aiming mark) the eye could become confused. If the target is blurred, the error is divided by 100 times and even if it's an indistinct blur, as long as it's round it will be possible to centralise it in the foresight.

A FORMULA FOR ERRORS

The error at the target equals the error at the eye, multiplied by the distance to the target and divided by the sight radius e.g.

Let the error at the target equal 'y'

Let the error at the eye equal 'x'

Let the distance to the target equal 'z'

Let the sight radius equal 'w'

Then we can represent the above statement as a formula: $y = \frac{x(z)}{w}$

Now we can substitute some typical values for this formula. Supposing you're shooting at 100 yards (91.46 Metres) and your sight radius is 1 metre which would be about normal; if you make a sighting error of 1 millimetre, which is not much, then our formula looks like this:

$$y = \frac{1.0 \text{ mm}(91.46 \times 1000 \text{ mm})}{1000 \text{ mm}} = 91.46 \text{ mm}$$

So an error at the eye of 1.0 mm results in an error on the target of 91.46mm (which for you non-Europeans means nearly four inches).

If you find yourself struggling, and your eye is hunting up and down between the target and the foresight, try looking away for a few seconds, but look at something which is about the same distance away as the end of your barrel. Your eye will then lock into focus at that distance and, when you look back through the sights, you'll find your eye much more willing to focus on the foresight.

If you wish to rest your eyes between shots, then do so by all means, but look at something neutral-coloured (green or grey) as far away as you can see.

However, it's not a good idea to subject your eyes to dramatic changes in light levels, which closing your eyes between shots (or shooting from a dark firing point onto a bright target) would do. Subjecting the eyes to constant changes of light level tends to make them tire more quickly, so a distant, neutral object is recommended as being most restful, but you should still look at something only a short distance away, as suggested above, immediately before looking through your sights.

Whatever you do, don't look at anything too bright. It takes only seconds for the iris in your eye to close down to protect it from bright light, but it can take much longer to open up when you get behind the sights again.

Eyesight problems are not always blindingly obvious; you may, for example, start a card well, then half way through the wheels come off, and you drop several points. You may have a bit of a shuffle around (or you may simply look to the heavens for inspiration), or you may have a short rest, and magically they will all start going in the middle again.

Hidden in amongst the catalogue of errors which produces this effect are your tired eyes struggling to maintain the correct focus. The level of concentration in smallbore target rifle shooting is so high that you can tend to develop a fixed stare, without really seeing what you're looking at.

Even with perfect eyesight you can still get a problem, because an image will become 'burnt' onto the retina at the back of your eyeball (like you used to get on the old computer monitors before 'screensavers' were introduced). Shooting quickly, and regularly looking away from the sight picture, will help overcome that problem.

Your foresight is approximately one metre from the eye so if you were to have a lens made up with a focal length of exactly one metre, your eye would naturally focus on the foresight when you looked through it, but everything else would be blurred.

The magic bit is that, because you're looking through a small pinhole, i.e. the aperture, the 'depth of field' increases such that things before and after the foresight are also in focus.

This means you could now say to the optician that you want a focal length of two metres, and the foresight would still be in focus; magically, however, the depth of field would extend much further towards the target, so it would become much clearer, which means that your brain is then free to concentrate on the foresight, and the target will appear as a reasonably clear black blob in the middle, without your eye trying to focus on it and without the foresight becoming blurred.

Even a small 0.25 or 0.5 diopter corrective lens with a two-metre focal length will make life easier for you if you're shooting after a hard day at work.

Just remember that you usually spend all your time looking at the world through *two* eyes and then you suddenly get down behind a rifle and expect *one* eye to do all the work. So if you give your eyesight a chance and help it, the reward should be an improvement in your scores.

Another function of the eyes that should be considered is their ability to act as a pair, which is what gives you binocular vision and enables you to judge distances.

This doesn't particularly affect your shooting because you're only using one eye to align your sights, but there are two things which *can* have an effect and can work against you, unless you're aware of their existence and are prepared to do something about them.

First of all, if you have two good eyes, which one do you use? The obvious answer is the right one if you're right-handed and the left one if you're left-handed but, unfortunately, that's not always the case. What you should really do is use the more dominant eye, but how do you decide which one that is? Well, that's easily accomplished by trying the following experiment.

Look at a distant object - something on the opposite side of the room, for example (like a light switch) - with both eyes open. Make a circle with the thumb and forefinger of either hand and, while still focussing on the light switch, ring it with the circle made by your fingers, and then shut one eye.

If the object remains within the circle, then you've just shut the eye which is *not* your master eye; if the object has moved out of the circle then you've just shut your master eye.

However, if you already wear glasses you may need to take them off before conducting this test, because they may be correcting any weakness in the non-master eye.

If you're shooting right-handed and your right eye is your master eye, don't change anything (this will be the situation in the majority of cases).

If your left eye is the master and you're shooting right-handed, don't despair. To a certain degree it will depend not just on which eye is the more dominant, but also on which one has fewer defects. As you only use one eye for aiming, it's possible to use the non-master eye by blanking off the other one and, providing there are no major defects in the aiming eye, good scores can still be achieved,

If you decide that your master eye is opposite to your normal 'handedness' you'll need to consider changing which way round you shoot. Unfortunately this can be expensive if you're an established shooter, because it could mean a new rifle and a new jacket, and, of course, you may find you have a total lack of co-ordination in your 'other' hand, which could cause trigger-release problems. However, some people have successfully switched 'hands' and have shot all the better for it.

Needless to say, there are alternatives, one of which is using extended sight bases which hang the sights off to one side of the rifle; both *Anschutz* and *Walther* used to manufacture these, but they no longer do so, which means you would need to track down something secondhand, or ask a small engineering company to make up a set.

Another option is the 'periscope' system, which, by means of mirrors, can bend the light rays through two right angles to line up with the other eye. These are not manufactured in this country any more, but *Gehmann* still produce one or you may find one of the others (made by John Kelly or Frank Spittle) cropping up occasionally on the secondhand market.

Although both these alternatives sound a little complicated, they do at least mean that you can carry on shooting with most of your standard equipment if you find your eyesight is failing in the eye you have been using.

The other thing to remember is that, even if you are using your master eye to aim with, the other eye may still be interfering with your sight picture. You shouldn't, for example, close or completely cover the non-aiming eye because, as mentioned earlier, your eyes work as a pair and cutting off the light from one of them affects the vision in the other.

If you have a very dominant master eye, then you may be able to leave the non-aiming eye looking straight down the range in a quite relaxed fashion. On the other hand, if you have good binocular vision you may find that you see two targets and two foresights as your brain interprets the signals from both eyes at the same time.

With concentration you can eliminate the target and foresight seen by the non-aiming eye. However, those of you who have difficulty concentrating at the best of times may find this extra burden too much, and could resort to putting something in front of the eye to break up its direct line of sight to the target.

What you actually use to interfere with the non-aiming eye is largely a matter of personal choice, but there are a few rules to bear in mind:

You should keep *both* eyes open and not too close to the sights; don't use a rubber eyecup so that light can't get in from the sides, otherwise the contrast between light and dark down the tunnel in front of your eye will be too much of a strain for it.

Don't wear an eye patch on the non-sighting eye - that's nearly as bad as closing your eye. As discussed elsewhere, the cone of central vision is very narrow - only about 5 degrees - so as objects get nearer to the periphery of our vision it becomes easier to ignore them; therefore you actually only need a fairly small obstruction in order to cut out the image seen by the non-aiming eye.

Another thing to remember is that, if you're shooting outdoors and trying to interpret wind flag movements, having plenty of vision in the non-aiming eye can help enormously with keeping an eye on changing wind conditions.

Therefore, a small 'blind' of some description is recommended; some people attach these to the rifle, others fix them to a headband, some attach a ready-made shield on to a set of shooting frames, or simply put a small patch on the non-aiming lens of their glasses if they use a system with two lenses. Settle on whichever you find the most convenient; don't just copy other people, but use their solutions as the basis of your experiments.

One important question you will have to sort out for yourself is the colour of any blind you use: black, white or opaque, or is a colour more suitable? Find out by experimenting to see which gives you the better sight picture. A small tip is to remember that if you start with an opaque one it's much easier to darken it, than to lighten a dark one.

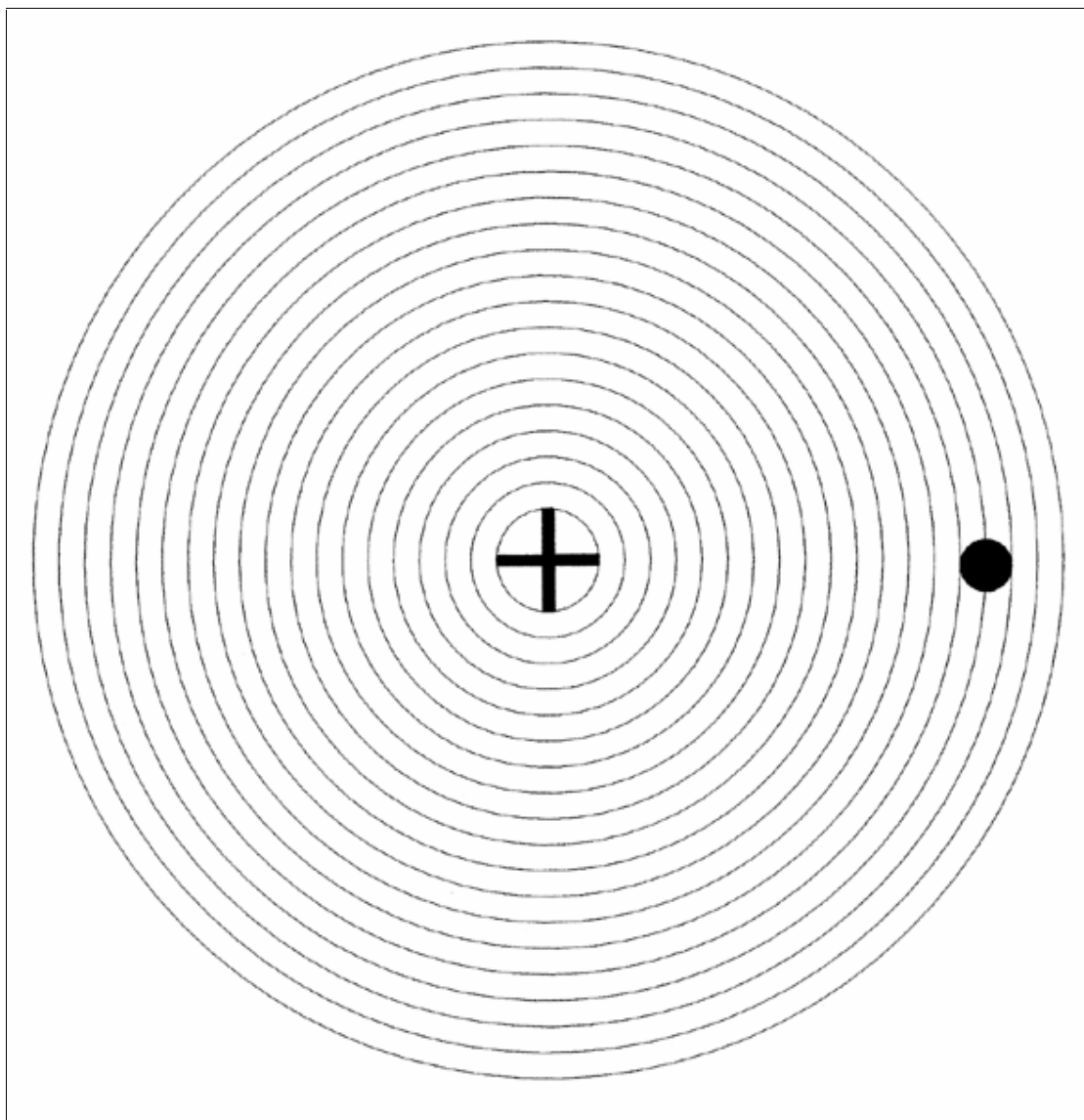
You may even find that a particular colour is more restful on the eye.

However, the sight picture is the most important thing, so find out what suits you best, and stick to it.

One important thing to bear in mind when thinking about your eyesight is that “seeing is not always believing” - your eyes can be fooled. For example, the brain receives electrical impulses from the retina in the back of your eyeball; these travel along the optic nerve and at the point where the optic nerve joins the eyeball there’s a blind spot on the retina.

Any light focussed by the lens in your eyeball on that spot will not register in your brain so, in effect, everyone is walking about with a blind spot in each eye, although you’re not aware of it, because the brain actually fills in what you don’t see.

Before incredulity strikes, please refer to the sketch.



Seeing should not be believing

Here you'll see a series of concentric rings with a black spot. Hold the page in front of you with the black spot slightly below the horizontal, to the right of the centre of the circles. Close your left eye and slowly bring the page towards you while concentrating on the centre of the circles. At a point approximately 15 cms from your eye, the black spot will disappear.

There's nothing really startling in that except that, where the spot was you can probably see that the concentric circles continue unbroken. Your brain has filled in what it thinks should be there.

The point is that you can't always trust what you see, as any good illusionist would tell you, and one way that shooters quite often fool themselves is by staring at the sight picture for too long. Those concentric circles and contrasting blacks and whites get 'burnt' onto the retina and the eye doesn't notice a deviation from the central hold.

You'll find if you try it, that you'll have to aim off an enormous amount if you want to deliberately shoot an 'eight'; in fact it's so far that, were you able to actually see the deviation, you would never pull the trigger. So it's entirely possible that your eyesight is fooling you when you get that 'eight' without trying.

It's an old but true saying that the best sight picture you get is the first one you see, and the longer you look, the more it will deteriorate. So if your shot hasn't gone in 10 seconds, you can almost certainly expect your sight picture to deteriorate.

Don't let this make you feel rushed into letting a shot go - by all means take your time in preparing for it, but don't stare at the sight picture until you're ready to release the shot, and if it doesn't go, look away while you prepare to try again.

CHAPTER 14

TRIGGERS AND TRIGGER CONTROL

Now is the time to talk about an extremely delicate part of the rifle which requires very careful and precise handling (or should that be fingering?): an often neglected piece of metal, which hangs down beneath the rifle and gets yanked by shooters to release the firing pin and start the process of cartridge ignition - the trigger.

‘Trigger’ refers to the whole unit - not just the part pulled by your finger - and its function is well worth investigating.

Triggers come in all shapes and sizes, and most match rifle shooters like as light a trigger action as they can get, although that’s not necessarily a good thing as light triggers can encourage a sloppy technique.

Back in the ‘Fifties the minimum trigger weight allowed was a 3 lb pull, and some club rifles were considerably more than that. One thing a heavy trigger does is to teach you good trigger technique, but before we delve too deeply into that, it’s worth examining the trigger itself to see how it works.

All triggers basically function the same way, i.e. they hold back either a hammer or a firing pin against a strong spring.

In its crudest form, found for example on sporting or military rifles, the trigger has very few moving parts, and a lot of the pressure from the mainspring is forced against the trigger, which means you need a fair amount of force to release it.

However, in a match rifle, the manufacturers interpose a lot of levers and springs between the firing pin and the trigger blade to reduce the amount of force required to release all that energy.

There are two basic designs of trigger which directly affect the shooter: two-stage or single-stage; both types have their followers and each group swears that they couldn’t possibly use the other.

The single-stage trigger has only one movement in the trigger blade, you put your finger on it and exert the necessary pressure until the trigger releases.

In the two-stage trigger, the first part of the pull appears to do nothing, but you come up against the second stage which will normally, but not necessarily, require you to exert more pressure in order to release the trigger.

The difference between the first and second stage can be adjusted by as much as 100 grammes, or more.

Both triggers require a quite different technique.

The critical part of a trigger, and the bit which does all the work, is the sear. This is the part that should, if manufactured correctly, take a lot of force but still move easily and smoothly out of the way when the trigger is pulled.

The amount the sear moves is relative to the amount of travel of the trigger blade. By means of a leverage system, the sear movement can be considerably less than that of the trigger; i.e. a movement of $\frac{1}{4}$ " of blade travel might result in only 0.001" at the sear.

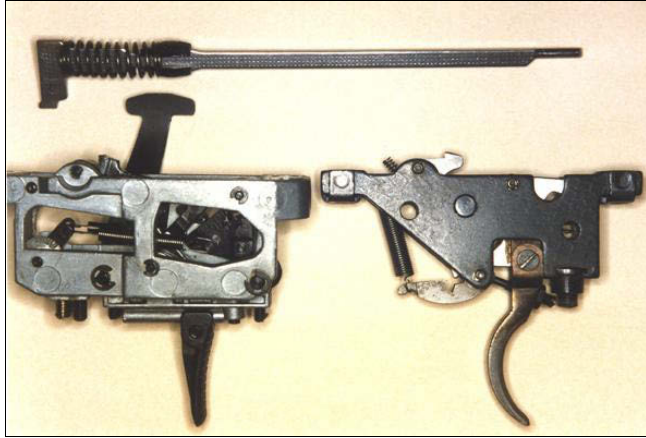
By giving the sear a smooth and hard edge, the firing pin can be held back ready to fire, with only the minutest amount of movement required at the finger to release the shot.

Various manufacturers have their different ways of producing the most precise trigger actions, and a lot of shooters just get used to the trigger they happen to be using, which they've adjusted to suit themselves.

The trigger becomes your own personal extension to your brain, and using somebody else's would be like driving somebody else's car. It would do the job, but it wouldn't feel like yours.

If you're going to have all these levers and springs and things in your trigger, that gives the manufacturers the opportunity of providing you with a wonderful amount of adjustment to play with.

In a single-stage trigger the adjustments are simple: weight and length of travel. The latter needs to be kept to an absolute minimum and the former is a question of personal choice, but most people plump for the absolute lightest.



The modern two-stage trigger is on the left and the old single-stage on the right

In a two-stage trigger these adjustments are immediately doubled because you need a length and a weight on the first stage, and the same on the second.

Then there is overtravel: should the trigger continue to move backwards after the sear has been released and, if so, by how much?

This is also a matter of personal preference, depending on your own technique; some people prefer very little overtravel and, providing they're sure they're not exerting pressure on the actual rifle during their follow-through, that will work for them.

Trigger blade adjustment is essential because we all have different-shaped hands and different finger lengths; it's important that your trigger finger contacts the blade at just the right angle and position, so the blade must be adjustable for reach.

Some rifle manufacturers have allowed some degree of adjustment of the trigger blade off to one side by swivelling sideways. This, is bad practice - it's better to leave the trigger blade on the centre line of the rifle and get the finger in the right position, rather than the other way round.

These are the basic adjustments necessary in a two-stage trigger - any more could be considered gilding the lily - and any major change in the range of the trigger weight could require more adjustment than is available by the weight screw.

Anschutz also provide cam adjustment on their triggers, which moves the weight range into a different bracket, but most *Anschutz* owners leave that well alone.

Modern technology has also produced something approaching the perfect trigger that works by electronics. Unfortunately technology has its drawbacks, and electronics need batteries which have limited lives and, therefore, you need a certain amount of organisation if you want to ensure that it doesn't let you down at an inopportune moment.

The sear still has to be held in position on an electronic trigger, but moving it out of the way is done by means of a solenoid. The battery charges up a capacitor with enough energy to move the solenoid, which then only requires the smallest of movements in the trigger blade to complete an electrical connection.

There was a rage back in the 'Eighties for fitting electronic triggers to match rifles, but it never really caught on, probably because of the cost, the question of reliability and the fact that a well set-up mechanical trigger can feel as good anyway.

What *should* a good trigger feel like? Until you've felt a really good, well set-up trigger you may never know, so don't be afraid to ask to try other people's triggers; comparing other people's triggers to your own could help you to evaluate your own trigger.

(Don't forget to supply your own plastic snap caps, of course - no .22 rifle should ever be fired empty as the firing pin may crash into the back of the barrel or, if not, it's brought to an abrupt halt by the bolt body which induces damage to the firing pin, possibly weakening it).

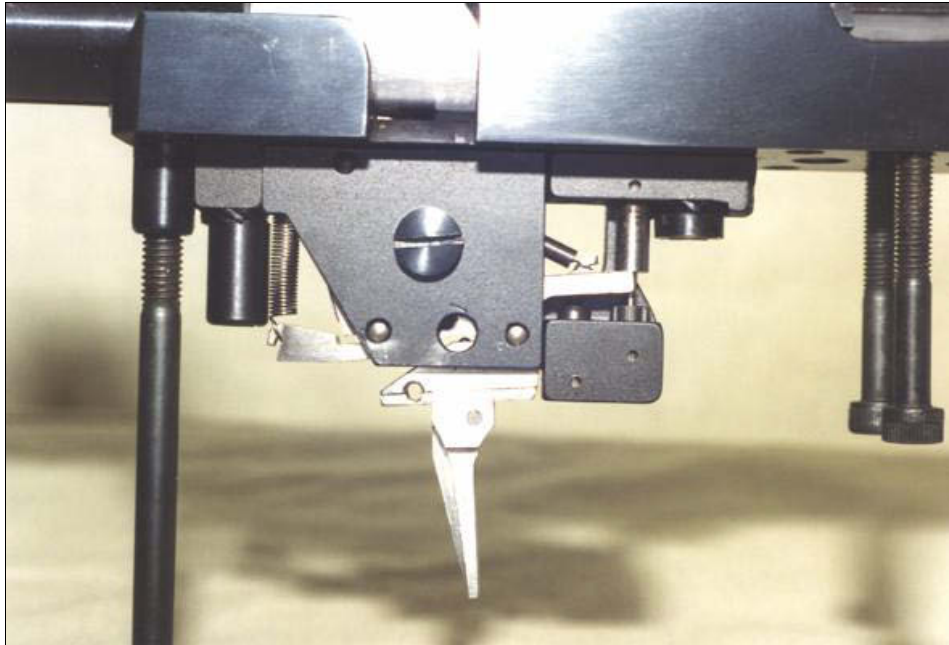
The really critical part of the trigger movement is at the point when it releases. If there's any creep at that point it will have a disastrous effect on your technique.

It makes no difference whether you use a single- or two-stage trigger - there should still be a very clean sharp break when the trigger releases.

If you're using a two-stage you should be able to take up the first pressure and then hold the trigger against the extra weight of the second stage; then, when you exert enough extra force the trigger should release without any extra movement until it releases the sear and firing pin.

On a single-stage the same principle applies, just without the first stage. If you want to see whether your trigger has any creep, cock the action (don't forget the snap cap) and then use a small screwdriver to push against the trigger; if you stand the rifle on a table you can observe any movement closely.

Push the trigger slowly and evenly up against its release point, hold it there and gradually increase the pressure. Any extra movement of the trigger blade before the let-off point should be visible.



A modern two-stage trigger

If the trigger has any creep before it releases, that's the time to make some adjustment.

Before you rush madly into twiddling every screw in sight on your trigger, a note of caution: most adjustments on triggers are inter-related. In other words if you adjust one thing then you could find it has influenced the setting on something else.

So the first step is to consult the instruction book - read everything it says about the trigger and identify all the parts before you attempt anything. You're probably looking for something called 'catch overlap' or 'sear engagement' or some such name, which is the part to adjust to remove the 'creep'.

Go carefully, and constantly check that you haven't gone too far. If the firing pin is not held back securely you could find the rifle firing when you close the action, which makes life difficult - and dangerous.

It's a good idea, if you've adjusted the sear engagement, to give the receiver a sharp tap, preferably with a piece of wood or a mallet with plastic faces. This will ensure that, when the action is cocked, there's no chance of the rifle firing accidentally if you jolt it or close the action.

Remember too that a turn of the screw which adjusts the sear engagement can mean a *lot* of movement at the sear, so proceed in small steps, say a quarter of a turn at a time. Clockwise *usually* means less sear engagement, but do check first.

If you go too far then the sear won't engage at all and you'll have to wind back until it does.

If you don't have a handbook, see if you can find someone in your club who does, and photocopy it; in the absence of any form of information about your trigger, enlist the aid of any other club members with the same model of rifle.

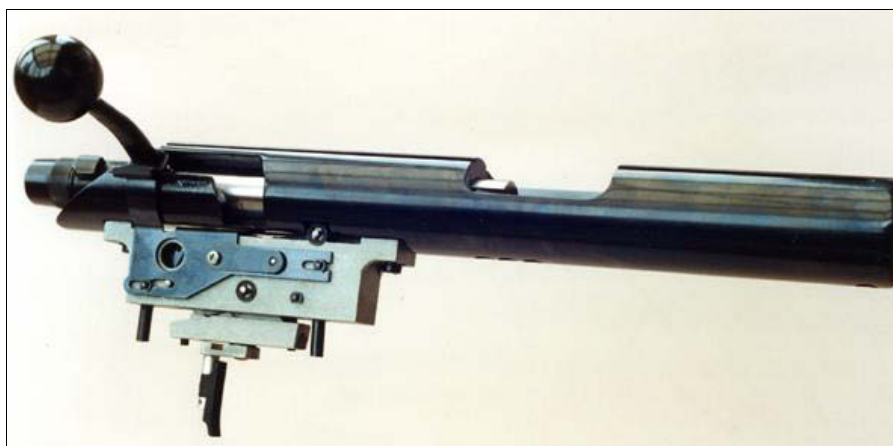
Weight and length of travel of the first stage are fairly obvious adjustments and can usually be worked out from careful observation of the trigger mechanism; generally these can be adjusted to suit individual preferences.

Just remember that some triggers don't like working at very light weights, so if you take all the tension off a spring it may not hold two parts together strongly enough to give consistent results.

A good trigger weight would be between 75 and 150 grammes and, if you're using a two-stage trigger then the first stage should be 50 or more grammes lighter than the second, so that there's a distinct difference between the two stages.

If you don't have a trigger weight test gauge then adjust to a weight you're comfortable with.

A good trigger technique can make the difference between winning and losing; a bad technique can drop you lots of points.



Another modern two-stage trigger

The next thing to look at is trigger control. The object of the exercise is to release the firing pin without disturbing your aim, and you have to do this with your trigger finger, which is attached to one of the finest tools known to man - the human hand!

The delicacy and precision with which the hand can be used is amply demonstrated by artists, sculptors and the like, so there's nothing to stop *you* turning your trigger technique into an art form.

Without delving too deeply into medical matters, try to consider your hand and the action of your trigger finger for a moment. Your hand actually works as a gripping tool with the thumb acting on one side and your fingers acting on the other. (Try picking something up without using your thumb and see how difficult it is.)

The tendons responsible for movement in the fingers come from the forearm, down through the wrist and out along the hand to the fingers. Unfortunately the muscles which contract (thereby moving the fingers) are all in the same group and whilst you think you're perfectly capable of moving just one finger at a time, very often there is sympathetic movement in the other tendons as well.

Try grasping the fingers of your hand with your trigger hand, as though it was the stock of your rifle, and then gently move your trigger finger; you may find that you can feel movement in the palm of your hands.

Experienced shooters are able to reduce this movement to the absolute minimum and therefore avoid exerting extra pressure on their rifle.

If you're not a top international - or even if you are - and you feel that there's a possibility that your trigger control is not all it should be, then read on.

Try imagining that your rifle is suspended from the roof of your firing point on two thin wires, such that it's able to swing freely, and that it's accurately aligned on the target. Then think how you would squeeze the trigger without disturbing the aim of the rifle, bearing in mind that the slightest pressure could swing it off target.

If you just put your trigger finger in the trigger guard and push backwards on the trigger, you can easily, even with only a few grammes of force, move the rifle off line.

Supposing you were to put your trigger finger lightly on the trigger, and your thumb directly behind either the trigger guard or in the thumbhole, or on the stock directly in line with the trigger and then squeeze them both

together. Don't you think that would give you the best chance of not exerting extraneous forces on the rifle?

When you're next in the firing position, take your trigger hand off the stock and try squeezing the trigger as described above.

The trigger hand exerting a force on the rifle can be responsible for all sorts of tension mistakes; if you feel that's a possibility in your case, take your hand *off* the rifle.

The main thing to remember is to be consistent in your grip - if you don't feel you can do that, it's easier to be consistent when you have no pressure bearing on the rifle. It's also important to have some form of location for your hand, to ensure that your trigger finger is presented to the trigger blade exactly the same way each time.

That may mean making light contact with the other fingers on the stock; you may even like to stick something onto the grip of your stock to help with that location. It doesn't matter what it is, just so long as you can feel it every time you put your hand near the stock.

If you shoot with a thumbhole stock, or one cut very low at the back, try to ensure that your thumb (somewhere between the nail and first joint) is actually lying behind - and directly in line with - the trigger.



Opposing thumb and forefinger

If you have a rifle that isn't cut away, you have no alternative but to stick your thumb up in the air somewhere off to one side at an unnatural angle. It's unnatural because if you were to hang your arms down by your side and completely relax your hand, you'd probably find that your thumb is hanging straight down opposite your trigger finger, so that's how you want it on the rifle.

The tip of your thumb is a very powerful digit and quite capable of exerting considerable force on the side of your rifle; we all know how a rifle reacts when it's forced onto a target - it doesn't like it at all!

So, keep your thumb on the centre line and you'll find it could help your trigger technique considerably.

If you've been shooting for 20 years with your thumb somewhere else you may have some difficulty changing, but remember that good trigger technique is of paramount importance, so if you're getting shots out where you're not expecting them, try a different system - as explained above - and see if it helps.

Smallbore rifles, unlike their fullbore counterparts, do not need heavy-handed gripping, and you may find a more relaxed grip makes a difference to the consistency of your group size.

It's a general rule that the rifle going off should come as a surprise, so you have to keep squeezing the trigger until it suddenly goes 'bang' and the hole appears in the target before you know it.

However, good trigger technique has to be learned and cultivated over the years and this involves three main parts of our bodies: the eye, the brain and the muscles.

You're laying there prepared to take the shot; you've centred the aiming mark in the foresight and you have eased off your breathing. The target remains reasonably steady and now you'd like the shot to go off.

Your eyes have accepted the sight picture, your finger is ready on the trigger, the first pressure has been exerted and now all it requires is just that little extra pressure to release the shot.

Messages are flashing along your nervous system from your eye to your brain, and deep inside your brain messages are flashing out to your muscles holding that pressure on the trigger.

Suddenly a connection is made with another part of the brain, which in turn sends a message to your muscles for that miniscule increase in pressure, enough to release the shot. All these impulses travel at the speed of light and suddenly the shot has gone before you're conscious of any increase in pressure.

Shooters invariably refer to this process as 'thinking the shot off' but there's more to it than that.

However steadily you think you're holding the rifle, it's not completely motionless; even though you may not be able to see any movement, it's still there, as anybody who's shot with a telescopic sight will tell you. This movement is involuntary, and is caused by heartbeat/pulse.

Top shooters have the ability always to release their shots on the resting phase of their heartbeat, without actually being able to control it. Obviously if you have a very slow heart rate, you increase the amount of time during which the heart is 'resting', so the fitter you are, the better.

Shots fired on different beats of the heart tend to enlarge the group, or create groups in different places, so one way of improving your technique is to train yourself to bring your trigger to a point of balance such that it takes the smallest amount of pressure to release it.

You need extremely fast reactions if you're shooting outdoors because you have to be able to read the wind conditions as well as concentrate on your sight picture, *and* get a message to your muscles when you want them to hold off.

Probably one of the most effective methods to use is a long steady squeeze of the trigger in order to reach the release point, but that method can at times be a little slow, particularly in tricky, fast-changing wind conditions.

'Slow', of course, is relative, and any shot release that takes longer than 10 seconds is going to start running into other problems, such as a deteriorating sight picture.

Another method of trigger release is increasing the pressure in a series of stages, i.e. increase pressure and hold it while everything is checked, increase pressure again and hold it while you do a final check, then increase the pressure once more and the shot is released.

It's amazing sometimes how a trigger which only requires a few grammes to release, can feel like you're pulling a milk float with your finger, particularly in a big match.

Because your brain is part of a chain of events it can sometimes interfere with the mechanical side - the messages don't quite get through to your trigger finger, and it appears to freeze. In sheer desperation you suddenly overcome the blockage and your finger slams back onto the trigger blade in a jerk; that does wonders for the size of your group!

Don't worry, everyone's done it at some time or other. The cure is to take your finger off the trigger *before* that desperation sets in, breathe slowly, and start again, or if you're allowed to go back onto the sighter, just dispose of the shot there and commence the whole cycle again.

With a two-stage trigger some people manage to avoid 'trigger freeze' by squeezing and releasing the first stage alternately. However, if you're a bit too casual in your approach to this, you can end up letting a shot go when you don't mean to, so take care if you use this method.

Many people find that, if a shot goes off when they least expect it, it can be a clean bull, much to their astonishment (and relief!), which only goes to prove the theory that the shot going off should be a surprise.

If you watch some of the very experienced top shooters, you find that they shoot very quickly indeed, and there's nothing wrong with that at all. They may only take 7 or 8 minutes for a 20-shot course, but they won't be sacrificing their trigger technique, they just won't be wasting time on reloading, spotting their shots, or holding on hoping for a better sight picture.

The next thing to consider is the actual position of your finger on the trigger, and you'll need to bear one or two things in mind.

Use the top pad of your finger (somewhere opposite the back end of the nail), then you're only trying to move one part of your finger when you increase the pressure. If you go too near the joint and the trigger blade slides into it, there's a risk of developing a sideways motion as well.

Practise holding your hand out and only moving just the very tip of your trigger finger; it's not easy, but it will help.

Next, arrange your hand so that no other part of your trigger finger is touching the rifle. (If you've taken on board the earlier comments about keeping your hand off the rifle, this bit is easy). Then, having decided which part of your finger is going to touch the trigger blade, you need some point on the trigger as a means of locating your finger in the same place every time.



Keep the full length of your trigger finger off the stock

Try adding a 'button' to your trigger blade: glue a small peg onto it so that your finger pushes the peg back and doesn't actually come into contact with the blade at all, then you can only ever be exerting pressure in the same place every time.

Whilst a number of people use trigger shoes, there is a case for saying that this is going the wrong way, as they do present a larger area to the finger and therefore allow more room for error, but some people find them reassuring.

If you happen to be shooting in really cold weather, it might be an idea to increase the trigger weight by 25 or 50 grammes. The reason for this is that, when your trigger finger gets cold you tend to lose the sense of feeling in the tip - particularly if you have poor circulation - and the heavier weight will allow you to be more aware of the trigger before it goes off.

If you do a lot of shooting outdoors in really cold weather, get a handwarmer. They work wonders on cold lifeless fingers in between details; after all, you're never going to be able to control your trigger release if you can't feel what your finger's doing.

So, if you don't want to throw away points, make sure your trigger is correctly adjusted, and concentrate on getting a good, clean release, with plenty of follow-through.



Concentrate on that trigger

TRIGGER ACTION

Describing in detail the action of releasing a firing pin so it ignites a cartridge is probably the most difficult task attempted by coaches or writers of shooting books.

It's all too easy to dismiss the whole operation as a 'pull' or a 'squeeze' or any other term you can think of to describe moving a small lever through a very small distance.

With heavy triggers, like the ones found on sporting or military rifles, you have no chance; there has to be a certain element of 'pull' involved because you're restricted by several pounds of tension in a spring.

Imagine lifting a 4 lb weight with your trigger finger: it requires muscular effort and is very difficult to do with the precision necessary in target rifle shooting, but today's sophisticated trigger, which can be operated safely at a few ounces, doesn't actually require much in the way of muscular effort and, therefore, can be operated very precisely.

It's that precise operation at very little pressure that we will attempt to describe here, but in order to do so we must go back to basics so that you can decide for yourself how you want your trigger to be released.

These comments and observations will apply equally to single- or two-stage triggers, because a two-stage trigger is the same as a single-stage, once you've taken up the initial stage.

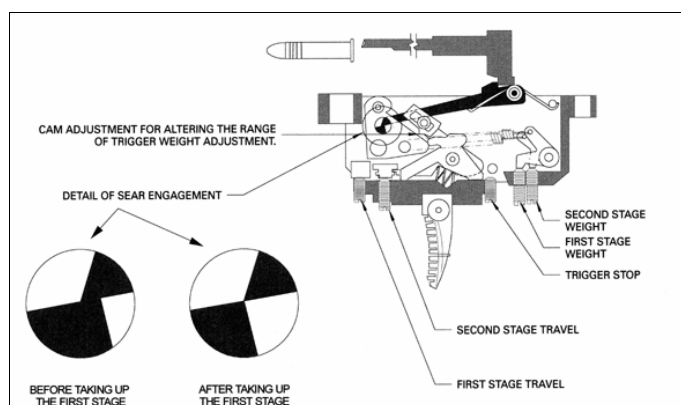
All match triggers have a sear and a bent inside, which are fairly meaningless names to the average shooter, and aren't really worth worrying about. However, basically the sear and bent are two lumps of metal - usually steel with sharp edges - which are held together with a series of springs and levers, such that they can be moved along each other against the pressure of springs and levers.

By attaching springs to the sear and bent so that they are held together, one can be dragged along the other and when one edge drops off the edge of the other, the firing pin is released.

If the two edges in contact are extremely hard and sharp you can probably understand that you could get those edges very close to the point of dropping off, yet still being safely held together.

In the case of a top quality match trigger the edge contact can be considerably less than a thousandth of an inch.

By using a series of levers, that sear is connected to a trigger blade with your finger resting on it. In order to get that minute amount of movement you have to move the trigger blade by a very small amount (not necessarily by the same amount as the contact at the sear, because of the lever action between your finger and the sear) but the less that movement is, the better the trigger.



The first stage takes the sear to the edge and the second stage takes it over

Now hold your trigger finger up in front of your eye and move it by one thousandth of an inch; it's extremely difficult because the human body can't be that precise and, in fact, when you release your trigger you just

increase the pressure on it until you overcome the resistance of the springs, the drag of friction between the surfaces and the inertia in the materials.

The amount the trigger blade moves to achieve this is down to fine adjustment of the trigger, but obviously the smaller that movement is, the less room there is for error.

The beauty of a good trigger is that it doesn't matter how much pressure you apply to it, it always releases at the same point, so some people could argue 'does it matter?' If your trigger is so sophisticated that it is always consistently released at, say 100 grammes (or about 4 oz) do you have to worry about being careful?

Well, let's suppose you pull your trigger with a force of 200 grammes and it releases at 100 grammes, where does that other 100 grammes of energy go? It could go into disturbing the rifle off aim, and while that doesn't sound a lot, it's one of the factors which could affect your group size, and, let's face it, you have enough variables without adding to them unnecessarily.

So - ideally - you apply just enough pressure to release the shot, and no more. But how do you achieve that?

It sounds simple enough - you just squeeze/pull/yank/jerk/push/tap/hit the trigger until it goes off! Like all things in target rifle shooting, nothing is that simple.

Supposing you were pushing a ball-bearing along a groove in a piece of wood towards a hole that was the same diameter as the ball; you know that if you push too hard and fast the ball will overshoot and not drop into the hole, so, as you approach the hole, you slow down until you can just roll the ball in with exactly the right amount of energy.

Imagine that the piece of wood was inclined upwards so you had to exert force on the ball all the time, and then hold it right on the lip of the hole. Now relate that to your shot release and hold the trigger just at the point of breaking, such that only the smallest increase in pressure is sufficient to release it. That will leave your brain free to do the rest when the conditions are right.

With practice you'll find you don't actually do anything to the trigger at all - it just goes off on its own and is a good shot (it may not be a bull, but that isn't because you snatched the trigger).

To understand how this happens we need to go back to basics again.

There are three main elements involved: your trigger finger, your brain and your eye; all these are connected, but not necessarily in the same way all the time.

Your eye is used to looking at the sight picture and your brain interprets what the eye sees; it then issues instructions to your trigger finger when the picture is right.

That all seems very straightforward, but in reality the operation is far more complex.

Your brain knows what a good sight picture is, and when it gets a message from the eyes showing all those lovely concentric rings, it says 'OK, now you can squeeze/pull/yank...etc. the trigger'.

In the meantime it's also checking on everything else, like the wind flags, your breathing, your position, etc. It should also be concentrating on the job in hand, not thinking about the last 'eight' you got and whether you're going to get another one, or whether you're going to reach the score you wanted, or what's for lunch.

In the middle of all those muscles holding your rifle are the muscle and tendon which operate the tip of your trigger finger. Having been sent a message from the brain via some motor neurones, it increases the force on the trigger blade just enough to release the shot.

(And while we're on this subject, this is another good reason for not having any tension in the arm as a result of gripping the rifle in the trigger hand. Life is difficult enough for that poor little muscle amongst all those big ones, without it having to fight its way through tension as well!)

Your brain, being the super computer it is, constantly analyses the input of information so that it can hold or cancel the trigger action at any time, should a wind flag change or you run out of breath, for example.

Very experienced top shots develop a function in the brain whereby they actually can leave out some of the brain activity which is involved in the sight recognition/trigger operation cycle. This can't be learned quickly - it comes from years of practice, and the best way to explain what happens is to use an allegory.

When a musician reads a piece of music and then plays a note, he goes through a similar process to a shooter. The eye sees the note, the brain decides which note it is and sends a message to the finger to press the appropriate key/string/valve, or whatever.

With practice a musician speeds up his sight-reading considerably until eventually there seems to be a more direct relationship between the eye and the finger. Everything is still going through the brain, but it's not using all the translation effort first required when the music was new.

You have no control over this short circuit - it's something which develops - but it becomes more noticeable when you start to release shots without realising it.

Each shot release should come as a surprise; this avoids the tendency to jerk the trigger when you *think* everything is right. Your brain has worked out that everything is right, so let it get on with it, and don't interfere.

Of course, when you're shooting badly you start to want to put more effort in, so you go the full circuit round your brain, analysing everything and then creating more errors by 'thinking your way out of the middle'. If you're going to let your brain do your shooting for you, don't overload it with irrelevant worries about past shots and don't give it too much work in releasing the trigger.

The ideal situation - and the one you're trying to achieve - is where the trigger is so finely balanced at the point of release that it takes the merest suggestion of a pulse running down your fingertip to provide sufficient extra pressure to release the shot, thereby ensuring the minimum of disturbance to the aim at the moment of shot release, while the bullet is still in the barrel.



A nice curved and relaxed trigger finger

There will be times when cold/wind/panic all interfere with this ideal situation, but if you strive for the ideal and can do it in perfect conditions, all the other problems just enlarge your group.

If you start off with your group larger than it needs to be in ideal conditions, then things are going to get a lot worse when the conditions are against you.

Now for a quick word about triggers in general: use whichever you prefer - single/two-stage/electronic - it doesn't matter, so long as it's set up correctly.

There must be no creep at the release point because if you're going to expect some poor little muscle and tendon to exert enough extra pressure to move the trigger sufficiently to release the shot, and then it finds it has to move it even further, you're not being fair.

If you want to know whether your trigger has creep, here are a couple of things to try:

Let a top-class shooter try it and see whether they can feel anything; or get a magnifying glass, push the trigger with a small screwdriver and watch carefully. Can you detect any movement at all before the trigger releases? If so, adjust it until you can't.

With the trigger set up correctly you will be 'thinking' the shot off rather than trying to make some conscious effort to pull/squeeze/yank/release it.

The number of points to be gained by perfecting your trigger technique are considerable, but it must be automatic, you can't afford the time to think about it too much because your brain has a lot of other things to do as well.

Time spent trying different ways of releasing the trigger smoothly and with the minimum amount of disturbance to the aim is time well spent, and you will benefit by getting better scores.

CHAPTER 15 OUTDOORS

In the UK smallbore target rifle is shot both indoors and outdoors. Outdoor shooting is usually at the longer ranges, because we tend to have small buildings in this country, and anything longer than 25 yards is unusual.

Beginners tend to start indoors and then progress to the longer ranges outdoors as they gain more experience; that's not a rule written in stone, just the way most clubs work. It's been shown over the years that, getting your technique right before you start trying to tackle the vagaries of the weather is good practice.

Remember, however, that shooting outdoors requires a little bit more equipment than indoors, so check through your bag to make sure you have wet-weather gear, bulldog clips, stop watch and possibly thermal underwear, even for the start of the 'summer' season.



What could be more inviting

For those of you embarking on your first season outdoors, here are a few tips:

IT'S NOT THAT DIFFICULT

Firstly, it's not as difficult as you may imagine. It *is* true that you have a lot more things to consider before your bullet arrives in the bull, but basically although the targets are further away they're also much bigger.

One other psychological difference is that outdoor targets are 'inward' gauging which can occasionally mean that something which looks like a 'nine' can still get you a 'bull' because, if the inner edge of the hole breaks the line, the shot scores 'in'.

Also, instead of one shot being fired at an aiming mark, you get to fire 5 or 10, which gives you a chance to see how your group is forming and do something about it if it isn't in the middle. Also, because you're firing more shots per aiming mark there's less moving around between shots, so it's easier to get settled into a rhythm.

You may have heard all sorts of horror stories in the clubroom about nasty winds that sneak up on you, or sun that disappears behind a cloud when you least expect it; even rain, hail and snow have been known to stop some club member somewhere from shooting a perfect score!

These are mostly just stories to entertain the troops around the fire on a cold winter's evening, designed to strike terror into the heart of the novice.

If you are a relative newcomer attempting your first summer season shooting outdoors, be reassured - it's not that difficult. It's true that your score ex 100 is going to be lower outdoors than indoors, but then so is everybody else's.

It's also true that you will have more things to contend with, but a good technique indoors will make for good shooting outdoors. There are far more points lost through bad technique than by adverse weather conditions.

EXTRA EQUIPMENT

However, before you start, here's a breakdown of some of the extra equipment you're going to need.

First and foremost, discuss with your fellow club members how exactly *they* fix their targets to the outdoor frames. Most people use bulldog clips and even if your club supplies them, or uses a different system, they are still essential for open shoots on other ranges and, of course, Bisley. They come in a variety of sizes, but in this instance, biggest is not always best.

Targets have been shredded by the wind because people were using the wrong type of clip; for example, the traditional clip is much more suitable than the fold-back type as the latter usually only grips on the very edge (unless you're using very small ones) as they're designed to hold large sheafs of paper. (They're also very powerful, with a mind of their own - particularly when you have cold wet fingers!)

So, go for the traditional style, but don't choose anything too large. The most effective clip is the one that, when opened to its maximum, just slides comfortably onto the target board; that way it lays flat against the target and holds it more securely. The most suitable size is 40mm-50mm (1½-2 inches)

You're likely to need at least 16 on ranges where you use backing sheets behind the targets and you'd be advised to carry some spares, as a clip which springs off unexpectedly can be gone forever. Also consider having some back-ups in a larger size (50mm-75mm) in case you encounter a range which uses thicker target board than you're used to.

Some people prefer to use coloured ones, which might help you to make sure that your scope is lined up on your target and not someone else's (hands up those experienced shooters who have tried to zero in on their neighbour's shots!).

Next you'll need some waterproof gear; it may seem obvious, but at some time or other you're going to get caught in the rain. One of those lightweight waterproof suits can mean the difference between comfort and misery, and they fold up very small, so they don't take up much room in your shooting bag. Keep a pair of waterproof boots in your car as well - you never know when you're going to need them. Even in the height of summer the early morning dew can soak through your trainers

Whilst on the subject of rain, keep a small cotton hand towel in your shooting kit - not for wiping down your rifle, but for wiping yourself down or for tucking in round your neck in really cold or wet weather.

You should also keep a can of *WD40* (or other water dispersant oil) in your kit. You can't stop shooting in the middle of a detail because it starts raining, so there's every possibility that your rifle is going to get wet.

Don't, whatever you do, put away a wet rifle; if you do, the next time you get it out it could be red with rust. If your case is foam lined, it will soak up water like a sponge and it will never dry out, so keep a rag in your kit, spray it with *WD40* and wipe down your gun; spray it again and wipe it down again before putting it away.

(Remember to take off your sights - or protect them - before you spray everything in sight, because oil residue is very difficult to remove from lenses and filters, not to mention adjustable foresights if they have perspex in them!)

COLD WEATHER

In the sort of weather which we usually get at the beginning of the season, you may find your trigger hand getting very cold, and this will affect your trigger technique.

Your local gunshop will have shooting gloves if you ask, but unfortunately they're not exactly suitable for target shooters. They're designed for shotgun shooters and are usually made of very thin leather with a fold-back cover for the trigger finger, but unfortunately you also need your other fingers exposed in order to pick up those tiny little .22 rounds.

As an alternative you could try a pair of fingerless woollen mitts; they're very cheap and will keep your trigger hand warm (you only need one, of course, as the other hand is encased in a big thick padded shooting glove).

TIMING

Now we come to another fairly essential piece of equipment. On an indoor range, firing 10 shots to count per detail, you're probably used to a range officer giving you 'start' and 'stop' instructions every 10 minutes. Outdoors you'll still have such a system, but the details are usually 20 minutes for 20 shots and it's therefore much easier to lose track of time, so a stopwatch is absolutely essential.

It's now quite difficult to find the traditional watch with a 'sweep' second hand, and you'll probably have to settle for one of those new digital timers, which not only tells you how many micro seconds have elapsed, but will also tell you which phase of the moon we're in and when your mother's birthday is!

Anyone with older eyes will find one of those electronic kitchen timers with huge numbers very useful. A word of advice here: a number of these have bells or beepers which sound when your time is up, and this can be most upsetting for your neighbours if they're about to take their final shot just as your bell goes off.

Some ranges are now talking about banning such devices (they are not allowed under international rules anyway), so it might be worth investing in a timer which counts up as well as down, so that you can simply start from zero and keep an eye on how much time you're using.

THE SPOTTING SCOPE

The next thing to consider is your spotting scope. Something good enough for 25 yards may not be up to coping with a dark wet morning at 100 yards.

However, before you rush out and spend hundreds of pounds on a new scope, give the old one a bit of a clean - it's amazing how many people neglect their scopes.

Don't take it to pieces unless you really know what you're doing, but at least give the lens a good polish (using the right equipment - don't just attack it with the nearest thing to hand, use a proper lens-cleaning cloth).

If that doesn't work, you may even be able to replace one of the lenses, which could have a magic effect on the scope's efficiency, but if that fails, then you may be in for a new scope.

Remember, you really do get what you pay for: a £300 scope is going to be twice as good as one costing £150; scopes do wear out, they lose their edge definition and this goes unnoticed by most shooters for years. It's not until you try to read your name on the card at the edge of your field of view that you realise what's happened.

Try this simple test the next time you're setting up your equipment. Focus your eyepiece so that you can *just* read some of the writing on the card if it's in the centre of the scope, then move the scope so that the writing is at the edge of the lens; can you still read it?

Be critical and honest - it's *you* who's going to suffer when you can't spot your shots because you can't get the right eye relief, or because the sun is in the wrong position (as so many people found out at Bisley one sunny year).

THE MAT

Your shooting mat takes on a much more important role when you're shooting outdoors. Indoors you could be laying on a nice smooth dry floor, but outdoors it could be anything but!

Most ranges have covered firing points, but many of them have at least one side exposed, which lets the rain in, so don't expect that every firing point you shoot on will be dry. This means that a shooting mat with at least a waterproof underside is an asset.

Also remember that outdoor firing points can have sharp nobbly bits just where you want to put your elbow, so a thicker mat would be advisable, or you could consider having an extra width of rubber to go under (or on top of) your existing mat. Under NSRA rules you're allowed a certain amount of extra padding on shooting mats provided it extends across the whole width of the mat (i.e. you can't just have a couple of patches where your elbows go).

Going back to the really cold weather at the start of the season, you might find a handwarmer useful. There are a variety of types available: one has a stick of charcoal inside which you light; there's also a throwaway chemical one, or a reusable one which you boil in water - they can make a wonderful difference to your hands on a cold day.

Don't let all this talk of cold wet weather put you off outdoor shooting, because it's not all like that, there are plenty of compensations. Shooting on a warm summer's evening in nice clear light, with not too much breeze, the birds singing, and all your shots going in - what could be nicer?



Despite what you may have heard, the sun does shine on rifle ranges

Just remember that for every miserable shoot there are plenty of wonderful, exciting, warm comfortable shoots to be had, and whilst we may not always have blazing hot summers, the weather really does warm up in June, July, August and September, so go out there and enjoy yourself.

WEATHER

In this country you're unlikely to meet any major weather phenomenon which would have a serious effect on your shooting. You may find yourself shooting in a snowstorm occasionally, but don't be put off by that - remember that biathlon shooters do it all the time.

Snow, ice, frost and even heavy dew will increase the amount of extraneous light bounding around all over the range (particularly if the sun comes out as well). But remember that, if you're at an open shoot, everybody else is suffering from the same problems, and the winner is usually the person who overcomes those difficulties and just shoots to their average.

If you tell yourself that you like shooting in a snowstorm, you may begin to believe it, and eventually you'll shoot better in those conditions.

The varied climate of the British Isles makes the weather forecast one of the most watched programmes on the television and to you, as a shooter, it can provide a lot of information. Wind direction and strength are always given, along with temperatures, likelihood of rain, etc. However, don't forget to take into account the distance you might be travelling to an open shoot (it's no good watching the local forecast then driving 100 miles or so westwards, only to find the weather's completely different!)

To most shooters 'weather' means wind, because they quite rightly believe that it is this element which has the greatest effect on their shooting, but there are other weather conditions which influence the group size.

THE SUN

Take, for example, the sun. It does occasionally appear in this country - in fact some people have been known to complain about *too much* sun during some national meetings. This is principally because they have trouble spotting their shots (particularly at 100 yards) as they can't see the shot holes until a group of two or three together forms (usually in the '8' ring).

All this means is that you *must* have the best possible spotting scope you can afford - in this instance money spent on buying the best is definitely not wasted.

The sun's effect on shooting tends to be more of a nuisance than anything - generally it doesn't actually force your shots out of the bull like the wind can.

On showery days the sun can be in and out quite quickly, particularly if it's breezy as well, and the clouds are scudding across the sky. In these circumstances there can be tremendous differences in light levels, which have an influence on where your shots go.

Exactly how much is difficult to say, but for example, if you've zeroed in on a dull light condition and the sun suddenly breaks through just as you're about to start on your match card, you'll need a certain period of time while your eye settles down to the new intensity of light.

(Of course, if you wait to let your eye adjust to the new level, the next cloud will obscure the sun just as you're ready to let the shot go, but that's life.)

We all know what the problems are, but how you cope with them? The first thing to remember is your Boy Scout training and 'be prepared'!

So many shooters at open meetings meticulously get their kit ready, or stand chatting to each other behind the firing point, without giving even the briefest glance upwards. A survey of the sky *before* you shoot could prepare you for what's likely happen during your squad.

If you're shooting a 20-minute detail, it would be a great help to know whether there's going to be 10 minutes' shade and 10 minutes' sun, or 5 and 15, or whatever. Watching the weather patterns before you shoot could give you a clue as to what might happen.

If you reckon on the 5 and 15 option, you could afford to wait for the sun to go in (or come out depending on how you've sighted in). If you think the former seems more likely then, unless know you can complete your card comfortably in 10 minutes, you're going to have to be prepared for some dramatic changes in light

There used to be an old saying about 'light up - sights up' but that probably doesn't apply to modern aperture sights. It was probably more relevant when people shot with a blade foresight. Just be aware that there could be a shift in the point of impact as the light changes.

What you can do to prepare yourself for such eventualities is pick the right sort of sunny day on your home range to experiment. With modern iris-and-filter backsight units, you can work out what the conditions are likely to be and make the necessary adjustments before you start shooting, but *only* if your survey of the sky tells you that you're going to get several minutes of one condition or another.

On some ranges the sun can get under the canopy (assuming the range has a canopy at all) in either early morning or late afternoon, and for that reason it's always a good idea to have a shooting hat in your bag. Even if you don't generally use one, in such extreme conditions you can shade your eyes when the sun is beating down on your head.

You may also have trouble spotting your shots if the sun's at the wrong angle, particularly if you're not using a backing card; a good quality scope will help here, not only because of its better lens system, but because most of them also have a sunshade which pulls out, to shield the front lens and help cut down the glare. However, a torn-up bit of target and an elastic band will serve the same purpose.

MIRAGE

Not only does the sun provide light, but it is also the principal source of warmth, so when it does appear from behind a cloud, there can be a major increase in ground and air temperature, which can mean the sudden appearance of mirage. (If you want to *see* the mirage, set your scope off to one side at 50 metres and you should see the air moving alongside the target; or slightly de-focus the scope until you're actually focussed on the air rather than the target).

If the ground is wet, the mirage will be slower to appear, but on a hot dry range it can happen in seconds; *then* your shots can lift up on the target and wander from side to side as the wind moves the mirage.

Mirage is often misread, and very misleading. But what is it?

Most people know that light travels in straight lines - that's a basic schoolboy fact - but there are qualifications to that statement which bear examination. School physics taught you that the reason a stick appeared bent when poked into water was because the light reaching you from the far end of the stick was refracted at the water's surface, i.e. at the point of change in density.

This refraction occurs with all density changes; it appears to 'bend' the light (or move the image of an object away from where it really is), and when this occurs in air masses of differing densities we call it 'mirage'.

The sun heats up the ground to different temperatures depending on the material involved (grass, concrete, etc.), so the air above gets heated by differing amounts and, as warm air is less dense than cold air, so light will be refracted at the change. It may, of course, be a gradual change but it's still refraction.

The parcels of warmer air are moved around by the wind and, in turn, create more wind. Storms, hurricanes, etc. are all created on the same basis and although you're unlikely to be shooting at the hurricane end of the scale, your shooting *is* liable to be affected by these embryo heat engines at the other end.

Imagine there's a bare patch of earth surrounded by grass halfway down the range. When the sun comes out the bare earth heats up quicker than its surroundings, so the air above it rises and its density changes, but the light from your target has to reach your eye through this warmer column of air, which causes the light to bend. Therefore, like the stick in the water, the target will appear to be in a different place to where it actually is.

In theory, this should be no problem, because all that happens is that your shots appear in a different place on the target and you adjust your sights accordingly but, nature being what it is, nothing is ever that simple.

The column of less dense, rising warm air won't keep still - it keeps drifting backwards and forwards which means that your target image is constantly moving. Inevitably this doesn't just occur in one spot, it's going on all over the range, so it's impossible to analyse exactly what's happening, or to find a foolproof solution.

Of course, it's not just the sun, which creates mirage; different densities will occur when a cold block of air moves across the range; this may not be quite so noticeable, but it's still there.

So how do you cope with all this? Firstly, don't panic!

If you've been shooting outdoors for some time you'll have already encountered mirage without realising it, but it doesn't always occur in the same way. You may have been avoiding wet ground and strong sun because you'd heard that this causes mirage, but there are other conditions which are worse: one of these is a gentle breeze, when the wind tends to change direction constantly, blowing the columns of air in all directions.

However, wind is also liable to gust, which could blow the mirage away and cause the wind's effects on the bullet to be reduced because the mirage has gone. Constant strong winds mix the air up much more, so there are no real blocks of air of differing densities to affect your sight picture.

Cool wet ground *reduces* the risk of mirage initially because the ground takes longer to warm up, but when it does, the humidity increases and so does the effect of mirage. Obviously, in strong sun with wet ground, you may get steam rising, but that's a different problem.

Grass also tends to reduce the chances of mirage, but as the grass gets shorter and drier, so it reduces insulation and the ground heats up more.

Hard, dry soil, clay and sand (particularly dark coloured) are all likely to produce terrible mirage, because they absorb heat on hot, sunny days. As most of these effects are related to temperature, mirage is always worse in the summer, when the sun's at its hottest.

Humidity has an effect on air movement because moist air is less dense than dry air (think of steam rising). So even in damp cloudy conditions there may be moving air out on the range interfering with your sight picture, which starts to explain why you sometimes have difficulty in shooting in apparently still conditions.

The height of the target above the ground also affects the amount of mirage you get because, as it rises, the air becomes more mixed up by the wind, and the mirage effect lessens. Therefore as you work your way down the three aiming marks on a 100 yards card, mirage will usually have the greatest effect on the bottom diagram.

HOW TO COPE

Understanding all of the above is all very well, but how do you cope with it and still shoot bulls? First examine the range you're shooting on; does it have large areas of hard ground with very little grass cover, is the grass short, etc.? Knowing what to expect before you start shooting is half the battle, then you won't waste time worrying about why your shots keep wandering from side to side on the target.

When you were shooting in a mirage without realising it, all you did was adjust your sights to compensate for the shots being high on the target and just watched the wind flags. Shooting successfully in a mirage is not that different, in fact mirage can be used to your advantage as a wind indicator.

Now you know what mirage is, you know what to look for, but how do you find it? It's very difficult to see with the naked eye, but it's much easier with a spotting scope. Remember: the more air you look through, the easier it is to see the mirage. So if you're shooting at 50 metres, you should look to one side of the target frame; the mirage between you and the stop butt will be much more noticeable there than in front of the target itself.

It's often said that defocussing the scope back from the target will help, but it's almost impossible to focus on a moving column of air, so the idea of defocussing is to make it easier on your eye. By not being focussed on the target it's easier to see the air moving. Watching this moving air through the scope is a much more reliable wind indicator than your wind flags, because you're watching the air move all the way down the range, not just in one spot.

On most ranges it's a little more difficult to spot the mirage when you're shooting at 100 yards because the targets are usually close to the stop butt. However, on some ranges (Century Range at Bisley, for example) the stop butt is a much further behind the targets and you can see the air moving around quite clearly on a hot day.

With no wind at all, the air tends to rise straight up, elongating the aiming mark in your foresight, and tempting you to shoot higher. This is simple enough to correct - just wind down a few clicks and you're in the bull. But if a wind flag starts to stir, although the breeze may not be enough to move your bullet, your next shots creep out of the bull. A quick glance through the scope will show the air streaming away in the direction your shots have gone, so it must be the effect of mirage, but what can you do?

You have two choices: either wait for your original condition to return, or aim off and generally treat the mirage like a wind which is being indicated by the air movement you can see. Wind blowing towards or away from you will change the direction of air movement quicker than a wind blowing across the range, as the crosswind tends to be more constant, whereas wind up and down the range will make the columns of air sway one way and then the other.

WOBBLY AIR

Try thinking of the aiming mark as a long black soap bubble attached at the bottom. A wind from the left would make it wobble off to the right and, because it's fixed at the bottom, it would slightly elongate upwards as well, causing you to take a slightly higher aim to the right. This is similar to the effect created between your eye and the target by those shifting wobbling masses of air.

The total effect on the target is slight - if you're accurately sighted in, you're talking about 'nines' at worst - but the problem occurs when you've allowed for this shift to one side and there's a sudden movement the other way. This will cause a dramatic change in point of impact on the target - now we're talking about 'eights' unless you spot this change and compensate for it.

There is a theory that using a larger foresight may also help because you may not follow the image quite so much as you would with a smaller foresight. This is quite possible, but for every theory there's a counter-theory, i.e. in typical mirage conditions (bright sun), the aiming mark appears much smaller anyway, so it's all a question of degree and comparison. By all means, try a larger foresight and see if it makes life easier.

You may find that a different colour filter helps, or try closing down the rearsight aperture by 0.1 mm, which increases the depth of field and helps your eyes to focus better.

Altering your sights could help you cope with mirage, but don't forget that an aperture sight is still an optical instrument, so although you can't actually see the mirage with the naked eye, you may still get some blurring because of the air movement in front of you.

It's all a question of experimenting - just find the combination which works best for you.

THE DREADED WIND

Then there's the wind itself.

Shooting in a wind usually strikes fear and terror into the heart of the average shooter, but don't despair, help is at hand! In this chapter, we're also going to tackle the problem of how to shoot in a wind.

Remember, it's not always the brilliant shot who wins, it's the shooter who copes best with the conditions on the day. The wind affects everybody on the range so although your score may be abysmal by your standards, if it's better than everybody else's then you win!

First of all we're going to examine what wind is, then how it affects your shooting, and then how you can cope with it.

Think of air as being an invisible, gaseous medium which is fluid and elastic, making it fairly unstable and easily moved. Differences in temperature (and therefore density and pressure) cause the air to move from one place to another, creating what we know as wind.

The main problem with wind is that it's not constant in either speed or direction, and it's very difficult to see. If you watch a field of wheat waving in the breeze, or the smoke from a chimney, you'll soon discover that it's very erratic and difficult to predict. So what can you do about it?

SMOKE

Obviously a thorough understanding of the capricious nature of wind will help. If you watch smoke from a very tall chimney, it tends to stream across the sky in a fairly straight and predictable line; compare this with smoke from a domestic chimney, which is usually far more erratic, then compare them both with a camp fire or barbecue, when the smoke gets in your eyes wherever you are. This shows that the nearer you get to the ground, the more wind variation you get.

Meteorologists call the prevailing wind which is smooth and unaffected by the terrain below it, the geostrophic wind and it occurs at 2,000 feet and above. Anything below that is affected by buildings, trees, hills, etc., as well as by friction with the ground. Unfortunately, we shoot at ground level where wind is at its most variable, although it's a bit slower because of friction with the ground.

Once you accept that wind is just air movement, it's fairly logical to accept that wind doesn't suddenly appear out of nowhere - it gives you some warning of its arrival. As a gust of wind comes towards you, it pushes other air along in front of it, so whatever wind indicators you're using will start to move, increase, and then drop away. However, the drop-off will be quicker than the rise, so some people prefer to shoot on a rising wind flag, as more points are dropped by not noticing a lull than by firing in a sudden gust of wind.

If you imagine that the wind or air moves like water, you can get an idea of what's involved by watching the swirls and eddies around piers and obstructions in a river's flow.

Each obstacle produces its own characteristic pattern, dependent upon its shape; a smooth, streamlined shape won't disturb the flow as much as an angular one, (which is why car manufacturers are so careful to smooth out the shape of their cars). So, how does this help the shooter?

Well, a quick look at the terrain upwind from your firing point may give you a clue as to the behaviour of the wind flags on the range. Open flat terrain might provide a constant wind which is fairly easily read, whereas broken terrain (trees, buildings, etc.) will cause eddies and turbulence, which are difficult to see until suddenly your chosen flag reverses direction, just as you let a shot go!

WAVES OF AIR

Understanding the way in which the wind behaves will help when going to a strange range. If you imagine waves of air pouring over an obstacle, this will give you a clue as to why wind flags by a bank behave differently to those in the middle of the range. However, if you draw a firing point next to a bank or wall, don't despair, it could work to your advantage if you make it.

You'll need to know the prevailing wind direction and then re-examine what you're shooting alongside. If you're on the downwind side of a wall, you can expect turbulence, downdrafts, and even wind at 180 degrees to the general wind direction; this will affect several firing points downwind.

If the wind is strong, there may be some shelter to be gained from the wall, it may protect you from the gusts, but what you will have to contend with is alternating and very twitchy wind flags. As you move further across the range, so the air flow will even out, but you need to remember that the higher the wall is, the greater the disturbance to the air flow, and the faster the air flow is, the greater the disturbance.

If you're on the upwind side of a wall, you'll also have difficulties as the wind bounces off the wall and creates eddies and turbulence, but the disturbance is much less and does not extend so far along the range as if you were downwind. You can determine the extent of disturbance across the range by reading the wind flags - that's what they're there for!

Other shapes obstructing the air flow will create differing types of turbulence. Think about a river flowing around square pier legs, compared with round ones, or even those specially designed not to hinder water flow, and you'll soon see that air flowing over a bank which gradually rises and falls, is not disturbed so much.

Most ranges are surrounded by trees, bushes, etc., and there are two things to remember about the effect of such vegetation on air flow: one is that it doesn't disturb the flow quite so much, and the other is that it actually shows the movement of the air over and around it.

It also tends to make a noise, giving you some warning of movement, although on a strange range you won't find this so easy to interpret as the locals do.

The problem with using vegetation as a wind indicator is that its effect varies depending on the thickness of the foliage, so wind flags are generally more reliable. A thick hedge will act like a solid wall or bank, but a sparse lumpy hedge will tend to vary the wind and create patches where any flags downwind will react differently to those over the rest of the range. How do you cope? The answer is to develop an awareness of your surroundings and their possible effect.

If you ever shoot on a range that's also used for fullbore shooting, you may find that the main wind flags are very high up and will tend to be more constant in direction than any flags near to the ground.

As a general rule, the eddies and turbulence enlarge your group and the main wind direction pushes the whole group to one side.

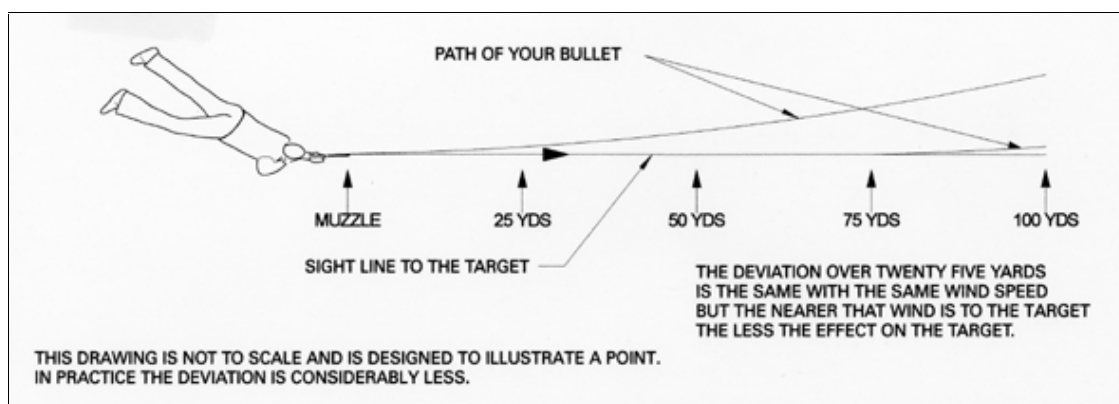
A sideways wind doesn't actually blow a bullet off course in the same way as it would a sailing boat. As the bullet exits the muzzle a wind coming from the left will cause the pressure on the bullet's left side to be increased by the pressure of the wind, and the bullet will veer towards the area of lower pressure. This is similar to the sailing boat, except, of course, that the bullet is spinning at something like 50,000 r.p.m.

Because most .22 target rifles are rifled clockwise, the bullet spins clockwise and, therefore, the high pressure area acting on the side of the bullet creeps upwards. Consequently, the low pressure area appears slightly below the centre line at about 4 o'clock and this is the direction in which the bullet will veer as it travels down range. A wind blowing from the right will tend to have the opposite effect and the bullet will veer to the left, and upwards.

As a shooter, you're obviously much more interested in what actually happens on the target, and most of you know that a wind from 9 o'clock or 3 o'clock creates a 4-10 o'clock wind group.

That part is simple - the problems arise when your technique for dealing with the wind is to 'aim off'. You must remember to allow for some elevation change, as well as sideways change (but more sideways than elevation - remember: it's 10 to 4, not 10.30 to 4.30).

For anybody who's still uncertain as to which wind flag to watch, it's important to realise that it's the wind nearest the muzzle that has the most effect on a bullet's path; the sketch graphically illustrates this.



If you have a choice watch the nearest wind flag

In the hypothetical case shown, the wind will deflect a bullet an equal amount over the first 25 yards, but once the bullet is pushed off course, it continues in a straight line, getting further from its original path all the time. It would require an equal and opposite force to push the bullet back onto its original course and that's extremely unlikely to happen.

When shooting through a circular wind it's important to react to the *nearest* flags, as the wind nearer the target would have to be many times stronger to blow the bullet back towards the target. So, watch a wind flag as near your muzzle as possible.

WEATHER FORECASTS

Watch the weather forecasts the night before your shoot - they always include information about wind direction and strength, but remember that this doesn't take into account local ground conditions at the range; these you'll have to sort out either when you're sighting in, or by studying the above and working out what effect buildings etc. are having on the prevailing wind when you get there.

Some people maintain that they shoot better in a wind and this can very often be the case, because a stiff breeze can sometimes be more readable. You can hear it and feel it more, so you can allow for it - and the only thing to be really wary of is a sudden lull, which can be hard to detect but has a very dramatic effect.

Some people have shot good cards by ignoring wind flags and relying on the feel of the wind on the rifle. This can be a very reliable method in strong winds: "I just fired when the rifle stopped blowing about", is a comment often heard around the more open ranges. The effect of wind on the bullet is nothing like as dramatic as the effect of the wind on the rifle itself: if your barrel is blown off target, then you'll certainly get a low-scoring shot, but if the bullet is blown off course, the result is rarely so bad.

LIGHT WINDS

While a strong wind can be dealt with by feel, what should you do about light winds?

With today's highly competitive standards every tenth of a millimetre (1/1000 inch) counts: the bullet either touches the line or it doesn't, and that difference can be as little as 0.10mm. There was an old rule of thumb guide which said that a 10 mph wind blowing constantly over 100 yards moves a bullet 4 inches off centre. So it's fairly obvious that even a light breeze is a potential loser of points, and any wind which exerts more pressure on one side of a bullet than the other is going to influence its direction down the range.

The trickiest wind to deal with is the light, switching wind, swirling and eddying across the range, making the wind flags twitch from side to side; however, like water

flowing down a river, these swirls and eddies do repeat themselves, so by watching the wind flags before you shoot, it's possible to determine an overall pattern.

The prevailing wind doesn't often make any major change in its direction during the period of the shoot, so the swirls and eddies will generally repeat themselves.

WIND FLAGS

If there are plenty of wind flags on the range, it's possible to follow the movement of the wind, by spotting flags upwind, watching what they do, and then seeing if that pattern repeats itself across the range. Watching a wheat field in the wind will show similar patterns of movement - air movement is the same, whether over a field or range, and the only difference is that the range isn't covered by so many wind indicators as the wheat field is.

When analysing wind flags and their performance, be sure to take into account their texture, material and weight; different ranges use a variety of flags and a 5mph wind will produce differing reactions from different wind flags, although its actual effect on your bullet will be the same.

UIT rules specify a certain construction of wind flags to ensure competitions shot under their rules all use the same material, but some competitions are shot under local rules and you may find all sorts of different types of flag.

If you're on a range without automatic target changers, you have the opportunity to walk along the path your bullet is going to take. Racing drivers and professional golfers 'walk the course', why not do the same? You'll be carrying your own personal wind indicator with you (i.e. your target) which will flap about while you feel the direction and strength of wind on your face.

A light breeze of 2-3.5 metres per second (5-8 mph) is the easiest wind to read, as it's strong enough to give a good wind flag movement, yet not quite strong enough to blow the rifle off the bull.

One thing to remember is that *no* wind is constant and there will be occasional gusts which will increase according to the average wind speed. For example, a wind speed of 4.5 mps (10 mph) may produce gusts of up to 7 mps (15 mph).

Gusts are sudden, but they don't last long because they're brought about by air rushing to fill an area of low pressure caused by the wind blowing around an object. They can quite often be heard or seen coming, and because of their short duration there's usually time to wait for their demise.

Having established that air moves in these repeating patterns, you're in with a chance of coping with the wind conditions; what you have to do now is determine which shooting method you're going to adopt in order to deal with them. There are nine

basic ways of shooting in a wind, but before examining them in detail, we need to adopt an approach which is going to bring success in dealing with the problem.

Most of you will have begun your .22 target rifle career indoors, and will have established yourself with suitable equipment and some sort of average before venturing outside, but, once outdoors, you'll also need to make some drastic changes to your approach and possibly your equipment. You need to develop an awareness of your surroundings, so it's no good being encumbered with a shooting hat with flaps, ear muffs, eye blinder, scope, etc. if you can't see the wind flags.

Be prepared to change your headgear: instead of a hat with flaps try a sweatband - it keeps the hair out of your eyes, stops the sweat running down your nose, and gives you somewhere to attach a small eye blinder if you need one. (Only a *small* eye blinder - it's important that you see as much of the range as possible, so if you need to use a blinder, keep it small).

Now look at your scope. Because most ranges face north, the prevailing winds are usually from the left, which is where, if you're a right-handed shooter, you'll find a spotting scope blocking out most of the field of vision. (Left-handers have an advantage over right-handers here, as in these conditions they can see the wind coming). Unfortunately no one yet makes a micro spotting scope with good enough optics for 100 yards, so the scope itself (and the way in which you use it) needs to be examined briefly.



Don't block your vision with the scope

Choose an angled spotting scope and position it as low down as possible, with the eyepiece angled up towards your non-shooting eye. This enables you to watch the flags upwind, with the left eye above the scope. Then, assuming you have a fairly straight position with your head level, you can look almost straight down the range, and easily see the movement of the flags to your left. (If you shoot in the old military 45-degree-angle style, then you are, in effect, turning your back on a lot of winds, and can expect to be caught out.)

Most people have about 180-degree peripheral vision, which allows you to register a flicker of a flag out of the corner of your eye, heralding a change in conditions. Of course, you *can* watch wind flags with your right eye, but only when the wind is coming from the right - you need to know what's approaching, not what's just gone past your rifle.

A wind coach, who sits with the wind behind them, calling direction and velocity to their team, using the flags *down* range is asking for trouble. By the time the condition has got through to the shooter's brain and thence to the trigger, most of the wind has reached the target and a new condition is affecting the muzzle.

Not using some form of ear protection is foolhardy, but the type you use is a matter of personal preference, as neither muffs nor plugs are likely to interfere with your view of the range. However, aspiring wind shooters may like to consider using plugs containing valves which shut down as the gun goes off, allowing you to hear the wind and to feel it whistling around your ear lobes.

Obviously concentration is of paramount importance, so there's no point listening to the wind rustling in the trees when you should be shooting, but at least it makes you more aware of your surroundings and of any possible changes in conditions. After all, while a particular condition prevails, then your shots stay in the group - it's a *change*, which is likely to cause a dropped shot.

You'll quite often find that in a competition with other shooters, you're waiting for a wind change so you can start shooting, only to find that almost everyone else is doing the same. The silence is eerie until the wind suddenly changes back to something you can shoot on, and you all start again. This shouldn't be a reliable source of information, but it can confirm your own judgement.

However, enough of general attitude and equipment, now down to the nitty gritty. How *do* you shoot in a wind? This sounds like the original question, but without some background knowledge and understanding of what causes the problem, how are you going to work out an answer?

Here now are nine basic methods of shooting in a wind - all of which are capable, to a greater or lesser degree, of producing the results on the day

Method 1: The "What Wind?" Approach (shooting through it)

This method assumes you can zero correctly so that, even when there's some wind about, you still get a nice '10 to 4' group across the ten ring, with shots on high and low winds still falling inside the bull.

Take extra care to ensure that the centre of the group is right in the middle of the bull as it's very easy to get eight shots in the bull and two in the nine ring, and dismiss the odd two as mistakes, by assuming the group is central. This may not be the case - the two 'nines' may be there because of condition changes, which will occur again with disastrous results.

Care taken on the sighter pays dividends later: the sighting target should be used to zero the rifle in the condition prevalent at the time of the shoot. Don't rush it, and don't make any hasty decisions about where the centre of the group is.

International rules don't allow you to return to the sighter, so you have to get it right while you have the chance, but this doesn't mean you should fire a whole box of ammunition at the sighter; there's no point in blasting away until a large ragged hole appears, then dashing round the actual card in the same way. Sighting shots should be shot with care.

By surveying the conditions first, you should be able to make adjustments before you even start on your sighter, so that your first shot arrives in the bull (or pretty close!). This saves a lot of time winding across the aiming mark trying to find the bull.

The next time you're shooting in a 'no wind' situation, take the trouble to set the windage knob on zero so you have a datum point to work from, then by careful judgement of wind speed and direction, you can add the necessary clicks onto the sight before you fire your first sighting shot; this leaves you more time to study the size of the group and the effect of any change in conditions.

Providing you're happy that the group is central and the conditions are staying constant, then the 'What Wind?' principle applies. Be alert, however, to any potential changes that may occur while you're shooting - don't wait until shots start creeping out of the group before you realise something's changed.

This method can work well in the right conditions and underlines a comment made some years ago by a well-known national coach that "good technique is worth two minutes of wind". It's all too easy to worry about *Will-o' the-Wisp* changing wind conditions, which have no effect on the group size.

There is another form of 'shooting through' wind, which I wouldn't recommend to a higher-averaged shooter, but which often works for those with a lower average: this involves totally ignoring the wind (as you have very little experience of it anyway), and, by luck or instinct, you can sometimes hit a rhythm which coincides with the

changing wind patterns and results in a clean respectable card, while more experienced shooters are struggling because they may be over-compensating. This is *also* known as the 'What Wind?' principle.

Method 2: Clicking off

Apart from adjusting your sights before starting on your sighter, this method isn't usually recommended for smallbore target rifle shooters, as it involves calculating wind strength and direction and applying the necessary number of clicks to the sights for those conditions, *for every shot!*

Because of the speed at which the average smallbore shooter has to perform (as compared with the fullbore shooter, for example) it becomes impossible to adjust quickly enough, or even to remember where you are.

Method 3: The Rhythm Method

This involves zeroing in on the sighter, starting on the match card and when any change in conditions occurs you return to the sighter and keep shooting until the shots go back in the bull (indicating that 'your' wind condition has returned) and then continue with your match card.

There are 'pro's.' and 'cons.' of course, as with any method. One of the advantages is that you retain a nice steady rhythm, instead of stopping and starting; the disadvantages are that it is expensive on ammunition, the sighter may get shot to pieces so eventually it's difficult to tell where the shots are going anyway. You could also run the risk of 'forgetting' where you are and cross-shoot on your own card or fire more (or less) than the correct number of shots to count. International rules, of course, don't allow you to return to your sighter once you've started on your card.

Method 4: Chasing shots

This method is practised by a lot of people, including some very experienced shooters who should know better, (despite it being wrong it *is* very tempting) - it's the lazy man's way of reading the wind.

It involves shooting until a shot drops out of the group, then looking at the conditions to see why; you then compensate until it happens again, or wait until your chosen condition returns and carry on shooting until you drop another shot, when you look at a wind flag and find it's changed through 180 degrees.

However, this system *has* been known to work in mild conditions (as described in **Method 1**) or in very changeable weather when you may consider shooting quickly to avoid suffering as many condition changes as those slower shooters alongside you.

'While they're going in, keep shooting' is the attitude required to make it work, but the problem occurs when your rhythm is broken and the shots start spreading without you knowing why. In this case, because you haven't analysed the conditions correctly, you're afraid to part with the next shot in case it's an 'eight'.



If it's good, keep shooting

Method 5: The Waiting Game

This is played by a large percentage of smallbore shooters; it involves zeroing in on a particular wind condition and only releasing a shot when that condition is present. It's a reliable method, as far as it goes, but it does have its drawbacks.

One is time: how often have you zeroed in on a wind that changes immediately you fire your first shot to count? Of course, if you'd been doing your job properly, then you would have studied the conditions beforehand and known not to trust a wind blowing from a strange direction for the 5 minutes you were on the sighter. It would have been better not to shoot at all during those 5 minutes if you knew that those conditions were unlikely to recur during the next 20 minutes.

If you use this method, it's important to shoot quickly, so that when the conditions you've sighted in on actually arrive, you're able to fire a number of good shots before they disappear and then have time to wait for them to return.

Practising any quick-firing discipline helps enormously here - if you've ever shot 10 shots in 90 seconds, or managed to get 15 shots off in a minute on a skirmisher target, then you'll realise that the 20 minutes allowed for 20 shots is ample, so don't panic. It's a good exercise in self-control to have only 5 minutes left to shoot your last 10 shots - you'll lose more points by panic spoiling your technique than you will by calm, calculated, rapid-fire shooting.

It's even more important with this than with any other method, to understand the capricious nature of the wind, because you're analysing the conditions for the whole range from perhaps just one flag. Your brain should be in 'computer' mode, good shooting technique should be automatic, shot release and sight picture must be perfect; then you can release all your spare concentration into analysing the flags and the sounds around you, while you're waiting for your condition to return.

Time spent reloading and scoping is lost time, so quick, accurate reloading is vital and don't waste time calculating your score through the scope!

This method of shooting has varying degrees of success, depending on wind direction and the number of wind indicators available. If you're watching a flag to your right and the wind is blowing from 3 o'clock, then by knowing the average duration of the conditions you'll have a fair idea of how many shots you can release before the wind changes. (Don't push your luck and let a shot go thinking it won't make much difference - that's not the way champions are made!).

Remember that it may also take a second or two for the condition which has affected your flag, to actually affect the path of your bullet, which is why it's obviously essential to watch flags *upwind*.

The major problem with watching one flag with only one eye is that it's more difficult to spot the changes in direction, which alter the wind's influence on your bullet. You rely on binocular vision to judge distance and it's much more difficult to tell whether a flag is blowing away from you or towards you if you're only using one eye. (Unfortunately, because of the obstruction caused by your sights, it's impossible to focus both eyes on a wind flag without lifting your head from the stock).

So how do you solve this problem? It all comes back to general awareness of your surroundings: listen to the wind, feel it on your face, or more on one ear than the other, see how the other flags are behaving and decide whether they indicate that your chosen flag needs watching more closely.

Now you begin to realise how busy the computer in your head can get. However, concentration is the real name of the game and while you're busy thinking about the changing conditions, you're not thinking about what you're going to have for tea or, even worse, what your score is so far.

You may find that your chosen condition coincides with everybody else's, and that you're waiting when they're waiting, but don't be lulled into a false sense of security, stick rigidly to your own calculations and analysis of the conditions, and don't start shooting just because everyone else has.

Assessing the conditions from behind the firing point before you shoot is invaluable, but be careful not to analyse the performance of any shooters who are already shooting. You may be able to spot their targets and try to work out what effect the conditions are having, but how would you know whether the shooter concerned was aiming off, or whether he made a mistake?

Also, you may start to get an impression of how well you ought to be shooting (particularly if you're in a higher class than the shooter you're watching), but if you begin your card and it starts to go wrong, it will go doubly wrong because you think you should be shooting better than you are.

Method 6: Coaching

This method can only be used for practice on your home range, or in special team events where allowed by the rules. It involves two people - one shooting and the other reading the wind conditions and calling out information to the shooter. The wind coach becomes the 'computer' and the shooter is just a machine whose only job is to release a perfect shot every time without taking any notice of the conditions at all.

There are lessons to be learnt from both jobs; if the coach is freed from the pressure of concentrating on the shooting techniques, he can analyse wind conditions easily. Likewise the shooter, freed from the constraints of trying to fathom out the conditions, can release perfect shots, but it's important to establish a form of communication, so that each of you understands what the other means.

Having served as wind coach a few times, you'll find that, while doing your own shooting you'll start to analyse the wind in the same manner; with lots of practice, reading the wind will become automatic and the computer between your ears will take over, freeing you to concentrate on shooting techniques.

Having been the coached shooter, you should be firing in the same conditions each time and will therefore be shooting very tight groups. Knowing that it's *possible* to shoot such tight groups in tricky conditions will help build your confidence when you're next faced with a difficult wind.

With two shooters of similar standards, it's interesting to see which of you reads the wind conditions better. With shooters of differing standards, say A Class and C Class, it would be interesting to see whether it's *analysing* the wind conditions which makes the difference, or whether it's the actual shooting technique.

As a club exercise it would be even more interesting to get your best shooter to wind coach a number of members of varying standards and see who improves their average.

Method 7: Aiming off (i.e. not aiming at the middle)

You may hear a shooter claim he could never aim off because he couldn't hit the bull when he was aiming at it, let alone when he wasn't. (A bit like the person who once claimed he'd never learn to ride a bicycle because he couldn't balance on it when it was standing still, let alone when it was moving!)

If you've never tried aiming off, do have a go; if you've tried it unsuccessfully, have another go. It's not easy and it takes a lot of practice but the rewards are considerable. Many good shooters have remarked that, in tricky wind conditions they've aimed off the whole time and have been amazed at how well they shot.

When the wind is blowing towards you or away from you, up or down the range, then it tends to 'fish tail', - i.e. switch direction repeatedly and quickly - and is very tricky to shoot in. Aiming off allows you to adapt to the conditions and use them to guide your shots into the bull.

Before starting to aim off, there are a few basic principles that must be understood. The first thing you should consider is your foresight size. It's important to use a size large enough to enable you to locate the aiming mark over to one side of the ring without it distorting or changing shape.

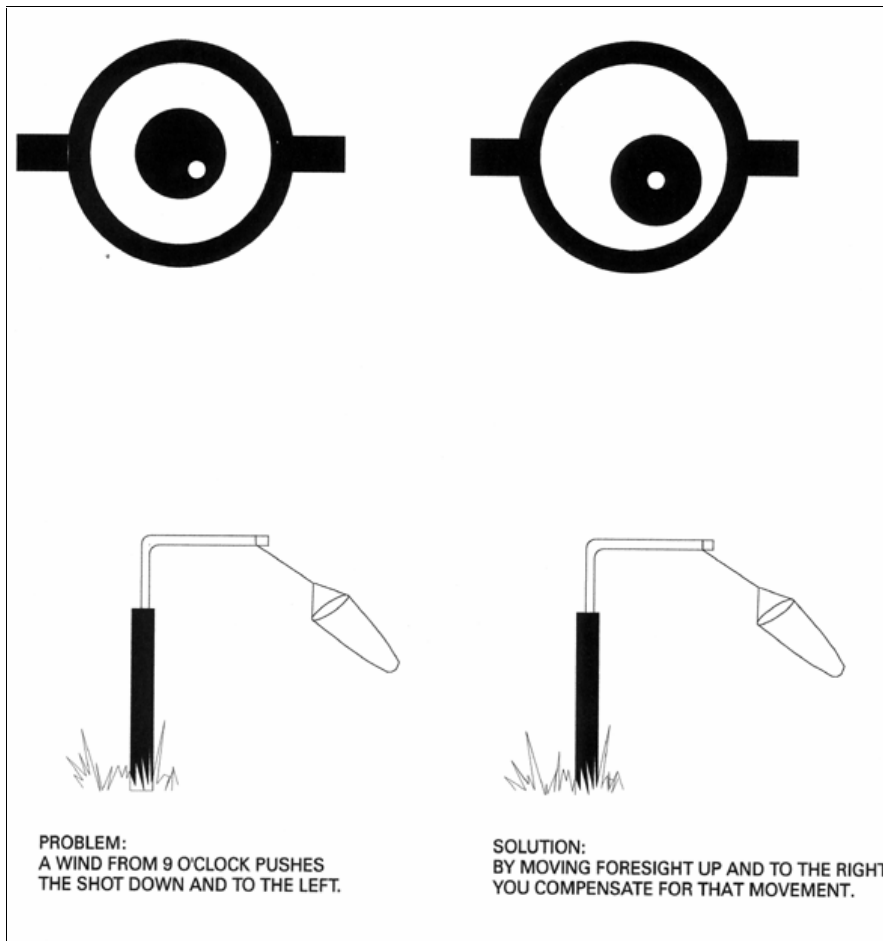
The problem with foresights is their ability to distort the sight picture by light refraction. For example, at 50 metres some people put their warming shots in between the two sighting diagrams, saying they can get both aiming marks inside their foresight and still get white around the outside edges of them. They're very distorted and oval in shape, but the 'white' is still there; however, it's not the white of the card they're seeing, but light being refracted round the inside edge of the foresight ring.

The amount by which you can aim off is governed by the size of your foresight: a larger one can allow the aiming mark to be moved further to one side (but this doesn't mean that a smaller foresight will make you adopt a central sight picture).

Next time you're practising indoors, try aiming off - you'll be surprised how far you have to go to get an eight. Then try it again with a larger foresight, say 0.4mm bigger than you usually use, was it easier to move the aiming mark around inside the foresight?

Or, try winding your sights 20 clicks to the right, sight in by aiming off (not clicking) and shoot 10 shots to count. Next, ask someone to alter your sights without telling you by how much, and do the same again. These exercises show the importance of your sight picture, and aiming off makes you concentrate on getting it exactly right.

Because you rely on concentric circles to align your sights, your brain can sometimes see what's not there, so if you stare at a sight picture for too long, the image can become burnt on the retina and the brain thinks the correct sight picture is there when it isn't.



There are occasions when an off-centre aim is successful

But by putting the aiming mark in the bottom right hand corner, you'll disrupt this cosy 'think it's all right' sight picture and suddenly you have to concentrate that much harder; consequently you could well be impressed by how small your groups are when you aim off. So next time you're on the outdoor range, don't zero in by altering the sights, do it by aiming off. It will be difficult, but by making it difficult on a practice card, you'll find it that much easier on a match card.

However, as mentioned earlier, because of the wind's effect on a bullet, very seldom should you make purely sideways adjustments in aiming off, there usually has to be some elevation adjustment as well.

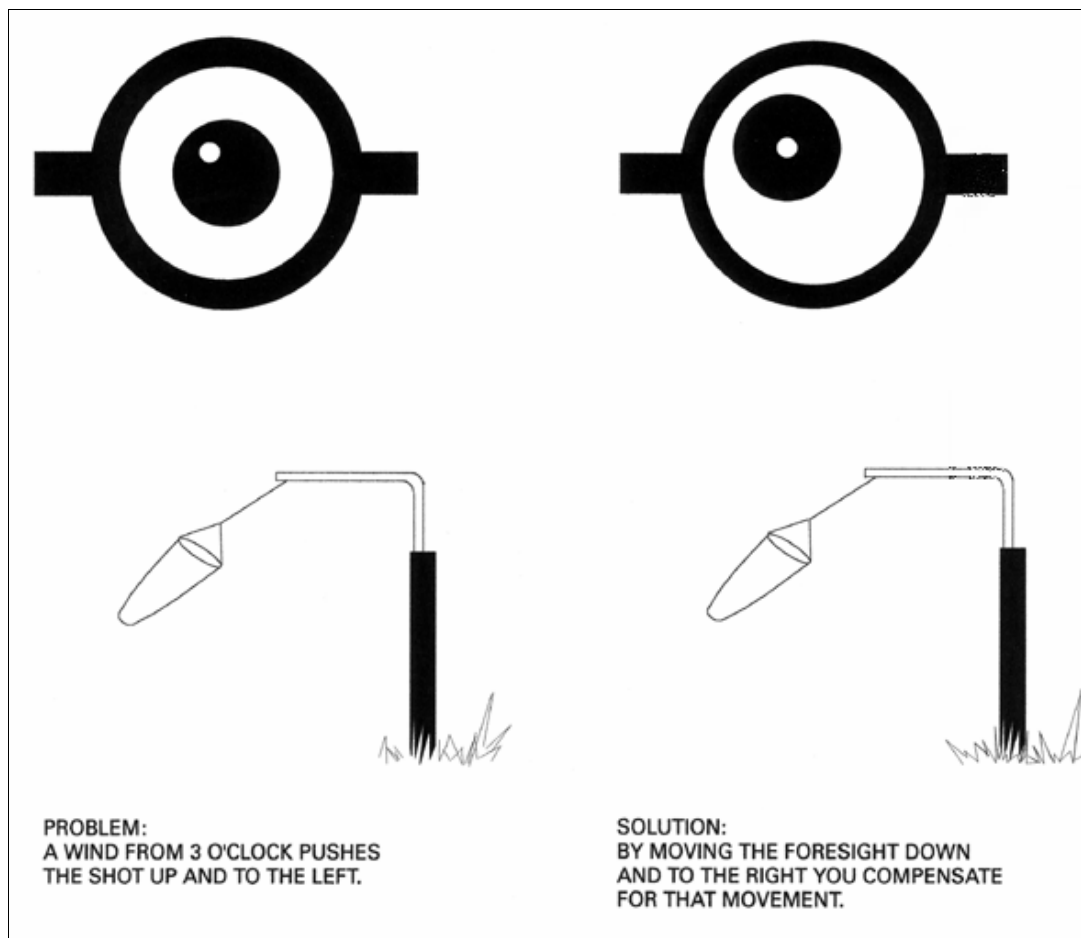
There are two basic levels of aiming off; one is to aim off, launching a bullet into space upwind so that the wind pressure blows it into the bull. This can be very successful, but can also be a bit 'hit and miss', particularly in a strong wind if you're relying on one wind flag to tell you what's happening over the whole of the range.

It is possible to shoot a neat group of carton bulls by aiming at the eight ring, which is no problem with a telescopic sight but with aperture sights it's not so easy to judge the amount by which you're aiming off. Therefore, great care must be taken to get the sight picture right.

Time spent on the sighter is important; this is where you choose the most prevalent wind condition, see where the shots are going, and measure how much to aim off. It's possible to pick a strong but steady wind condition which produces an 'eight' at 10 o'clock when you aim centrally, and by progressively aiming further to the right and down, you should be able to 'walk' the shot holes into the bull.

Reducing the amount of aim off can cater for a change in conditions, such as a drop in velocity; a change in direction may require a different aim point or a pause until the prevailing conditions return.

Most people hesitate to aim off because of the apparent amount needed to turn an 'eight' into a 'bull', but in strong windy conditions, when there's no alternative, it has been known for top shooters to aim at the edge of the target board and still shoot bulls. The problem is that, the further you have to aim off, the more guesswork creeps in.



Get used to shooting left and right winds by aiming off

There is a more reliable way of aiming off but it really only works in the sort of light wind conditions, which cause a 'squeaky nine' at the worst. This is generally referred to as 'shading', where the degree of aiming off is much less and it's a case of favouring one side more than the other. This demands even more concentration on the sight picture, because the change in shape of the white surrounding the aiming mark is so slight.

Where it comes into its own is when the group starts to build up on one side of the bull, uncomfortably close to the line, with the risk that the group might spread across into the 'nine' ring. 'Shading' to spread the group into the bull can work wonders then, but overdoing it can result in a 'nine' on the other side, so until you've gained confidence in this technique, tread very carefully.

It's vital when aiming off to ensure that everything else involved in the shot release is perfect. Errors in trigger release, etc. could cause total confusion when a hole appears on the card in a totally different place to where you've just calculated it should be.

Don't be tempted to use the rearsight for aiming off, as this doesn't produce a true picture. You should still keep the foresight exactly in the centre of the rearsight - it's just the aiming mark which can be displaced.

Method 8: Induced Error

If you could release a perfect shot every time, then obviously your group would be as small as the rifle and ammunition would allow. However, the fact that very few people shoot groups that small means that some errors must be introduced into this combination, which result in a shot drifting out of the group. Therefore the next logical step is to wonder whether you can induce the shot to go where you want it to by introducing a predetermined error.

Aiming off is one example, but another area where this can be carefully controlled is in the use of cant. Everybody shoots with some degree of cant (it may be zero degrees of course!) and most people cant the rifle towards themselves, to keep their head upright and their eyes level. Therefore, you need some device to ensure that your cant is constant - hence the spirit level or levelling bars, which some people use.

Altering the degree of cant will move the point of impact on the target. Six minutes of cant will move the bullet from 'bull' to 'nine' ring, or *vice versa*; the first movement is sideways and this then gradually falls away in an arc from the bull.

If you sight in on the downwind side of the bull on the basis that a drop in the wind will cause the shots to fall into the bull, you could find that an increase in wind strength will move them out towards the 'nine' ring. If this happens, the thing to do is, cant into the wind, *just enough* to force the centre of the group back towards the middle (if you do it too much you'll lose some elevation). You can treat winds from the left or right exactly the same, and with a foresight bubble the amount of cant you use can be judged consistently.

Naturally, people all over the country are exclaiming in horror at the idea of introducing errors into shooting when they've spent so long trying to eliminate them, but these methods are used very successfully by some people, so don't dismiss them out of hand.

Of course, they're not in themselves the total answer, but they may provide an insight into what's happening when you shoot, and the moment you give up listening to ideas, or experimenting, then you start to stagnate.

One top shooter lifts his shots up on the target by tensing his left hand (he's right-handed of course); another varies the pressure on his cheekpiece to move the point of impact. Both these people have reached the stage where they're capable of releasing perfect shots, which means they can be sure that the error they've introduced is the only one influencing the path of the bullet.

Method 9: The Ultimate

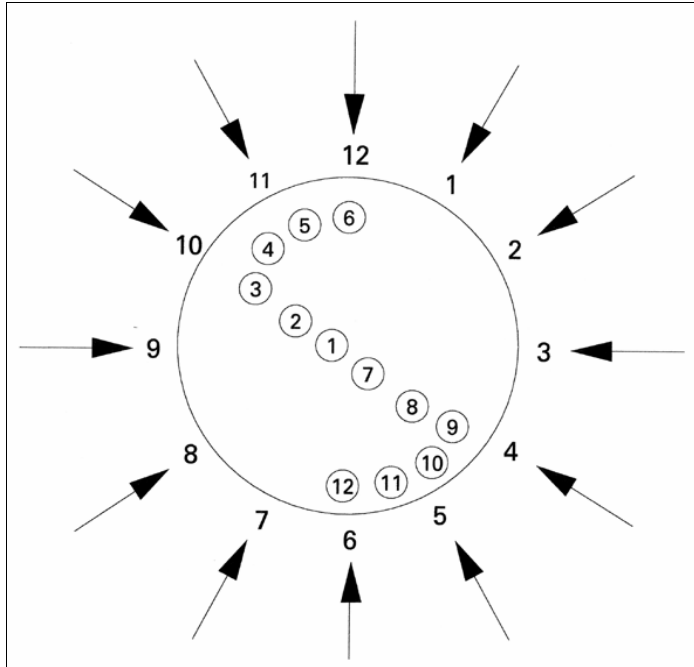
This is by far the best method. Basically, it involves using all the previous methods, or parts thereof, or any combination from 1 to 8. Likely combinations might involve waiting (Method 5) and aiming off (Method 7) - to some extent, Method 7 will involve using Method 5 anyway, because very few people dare shoot in a gust. If you've tried them all, there will be some you get on with and some you don't, but if you don't try them, you'll never know!

Keep your eyes open: a wind coming towards you will have an effect on 90% of the bullets path before it even reaches your wind flag, particularly if the only one you're watching is at 10 metres from the firing point. In this case you might like to consider modifying your shot release technique if you're shooting in a tricky wind.

In some wind conditions the changes come so quickly that, if you have a slow, steady trigger release and you're shooting by waiting for the wind or aiming off, you may find the conditions actually changing while you're releasing the shot.

There are two ways of coping with this; the first and most obvious is to speed up the shot release by practising shooting quickly. Plenty of practice at this will pay dividends in a match, but don't be tempted to rush or to snatch the trigger, as this will drop you more points than the wind. The second solution lies in the ability to read a wind flag out of the corner of your eye while letting the shot go (*and* holding off when you catch a changing flicker from that wind flag).

Winds coming up the range towards you or down the range from behind you don't have the same sideways effect on your bullet. Generally, a wind group on a target spreads from 10 o'clock to 4 o'clock, to a greater or lesser degree, depending on wind strength and/or direction. This is where the picture being built up on the sighter while you're testing all the different wind conditions pays off, as the wind's effect can be gauged very accurately. There's a neat little diagram, which shows this:



The wind clock

The numbers are hours on a clock face, where a 6 o'clock wind comes from directly behind you. As mentioned previously, the 3 o'clock wind moves the shot up and to the left and the 9 o'clock *vice versa*. Don't however, gauge wind strength and direction by the smoke from your barrel, because the bullet is already on its way by then (but your neighbour's smoke might give you a clue).

In really strong winds, be prepared to grip the rifle more tightly (preferably without introducing grip errors) to cut down the possibility of the wind blowing your rifle onto your trigger finger, which could be disastrous. Once a bullet leaves your rifle going in the wrong direction, you can't call it back!

If it's that difficult in windy conditions and you can still put up decent scores, then why can't you shoot better in perfect conditions? The answer is that, very rarely in this country do we ever get perfect conditions for shooting.

There may not be much wind blowing, but the air never stays still, it's a very fluid medium which is always on the move and which is constantly changing its density, temperature and pressure. Think of apparently still air as jelly, which wobbles invisibly across the range.

Smoke canisters have shown, when lit in *apparently* still conditions on a range, that the smoke swirls everywhere and the amount of movement is difficult to believe when the wind flags are absolutely still.

This movement is not sufficient to blow a bullet off course, but things are very often not what they seem, and you may be having difficulty because you're looking through several layers of moving wobbly air at different temperatures and densities. The wind flags may be hanging limply, but there is still movement out there, so tread warily and shoot carefully.

Remember it's the increase in pressure on one side of the bullet that influences its course, *not* that it gets *physically* blown in a different direction.

Apparently-still conditions can also induce a feeling of overconfidence and lack of attention to the basics of shooting, allowing your brain to wander, simply because it's not watching the wind.

There's another wind phenomenon which can have a dramatic effect on your shooting during the summer, and that's the wind associated with *Cumulonimbus* cloud formations.

The section on mirage explained how wind gets started by warm air rising and being replaced by cooler air. As the temperature rises, this simple convection current increases until eventually the warm air rises so high that it's cooled down again sufficiently for the moisture in the air to be condensed to form clouds.

During the summer, when the sun can get very hot, these cloud formations can become enormous, and the rising current of air beneath them (so loved by glider pilots) can be quite strong. Consequently, when the air rushes in at ground level to replace the rising air, quite strong wind speeds can be reached. The problem which will affect you most is that this 'heat engine' sucks air in from all directions and yet still gets blown around by the general wind direction.

Therefore, if the summer sky is showing signs of producing large bulbous white clouds, you can expect these to develop into *Cumulonimbus*. The really big ones will be very dark underneath and so high that the top has flattened out into an anvil shape. This cloud could be up to nine miles high, and anything that pushes upwards to that height will be sucking air in at ground level at a prodigious rate!

So, beware as this monster approaches, because you could get a total wind reversal as it draws in air from in front of itself. There will come a time when the wind peaks, then drops off to near-calm conditions and then starts off again but from totally the opposite direction.

However, this heat engine is being blown along by the general wind direction so you shouldn't necessarily expect all this to happen immediately under the cloud - you're dealing with a leaning column of air caused by the wind being stronger higher up in the sky.

Beware of strange ranges which appear to give shelter from the wind, as ranges which are built in seemingly ideal conditions (e.g. in a quarry rather than in the middle of open fields) can generate their own little idiosyncrasies, designed to catch out the unwary.

As mentioned earlier, when a large mass of moving air meets an obstacle, its path is interrupted and turbulence is created; the same thing happens when it comes across a hole in the ground, i.e. a quarry. If the wind is very strong, it will rush across the top, dragging air out; if the wind is slower, then it may tend to go in at one end and out the other; if there's a temperature difference, which is quite likely if the sun is out, then warm air may rise up the walls like smoke going up a chimney.

What the quarry is doing is introducing an upward or downward air movement, which causes even more problems, and it's creating a circulating effect, which causes the wind flags to spin round in a most disturbing manner.

This may sound terribly difficult to cope with, but at least the air movements tend to be lighter in a quarry than on a cliff top. There's one theory in this situation which has some success, and that is: the more confusing the wind, the more you ignore it! Adjusting for conflicting wind flag movements can leave you constantly chasing your shots all round the diagram and making other errors in your frustration.

Trying to analyse these twitchy wind flags before you shoot may cause brain fade but whatever you do, don't panic; if you really can't figure out what's happening beforehand, then wait till you get on your sighter and see what's *actually* going on. You may find the conflicting flag movements are doing no more than enlarging your group slightly, so, with a great deal of care (ensuring your group is central) you should be able to keep the dropped shots to a minimum.

Circulating winds don't only occur in confined spaces, they can also appear on wide open ranges. Wind eddies created by an obstruction will continue downwind of the obstruction for some distance, and wind created by rising warm air currents can start a circular motion which is then blown along in the general wind direction.

Remember, whichever way the wind flags are blowing, it's the one nearest your muzzle that will have the greatest effect on your shot.

It's a well-known fact that, when you're shooting well, the wind seems to have less effect on your group size; at other times, when nothing seems to be going right, the wind blows your shots from nine ring to nine ring, however hard you try to contain them.

When this happens, it's important not to forget your basic techniques; if you can guarantee shooting 'possibles' all the time in perfect indoor conditions, then outdoors at longer ranges you can make allowances for the wind, knowing that if you haven't hit the middle, it's a result of the wind conditions, *not* your shooting technique.

Unfortunately not many people can make that sort of guarantee, so you end up constantly analysing your performance as well as reading the wind conditions, but you have to know that the shot was a bull when it left you, before you can analyse the wind's effect on it.

These are some of the methods used by top shooters to cope with the varying wind conditions, which occur in this country.

Finally, don't be afraid of the wind, it doesn't select you as its personal target; it affects everybody equally and, as mentioned earlier, it's the shooter who best copes with the conditions on the day who wins, so don't give up however badly you *appear* to be shooting it's not over until the last shot is fired.

CHAPTER 16

MECHANICAL TOYS TO AID SHOOTING IN THE WIND

After all the thoughts on wind and how to shoot in it, now is the time to consider any possible mechanical aids which might help, rather than having to rely solely on wind flags. There have been several on the market over the years - some help, others don't. To evaluate the benefits you have to understand how they work and whether they'll work for your style of shooting.

The problem with relying on wind flags is that a lot of people are unable to see them through the rearsight - they tend to be off at an angle, away from the sight line and the bullet's path. This means you end up looking across at a flag, then back to the sights, possibly several times before releasing a shot in a twitchy fishtailing wind.

If your hold's good it may not matter if you release a shot while not looking through your sights, but obviously it would be better if you could actually have your chosen wind flag within your central vision.

Most people have 180-degree peripheral vision, but the core of your central vision is very small - about 5 degrees - therefore while you might pick up the flicker of a change in a wind flag, you still have to look directly at the flag to measure its position.

The closer an object gets to your central vision, the easier it is to see it; therefore being able to see wind flags alongside your sight line is probably an advantage - 'probably' because not everyone will react the same way; for example, some people may find that flags fluttering so close to their sight line cause a distraction.

People often remark that they've shot well while being able to see a wind flag in their foresight; some people have even shot with a flag fluttering across their target, only releasing a shot when they could actually see the aiming mark! That's not something to be recommended but it does indicate that being able to see a wind flag through your sights may be of some use.

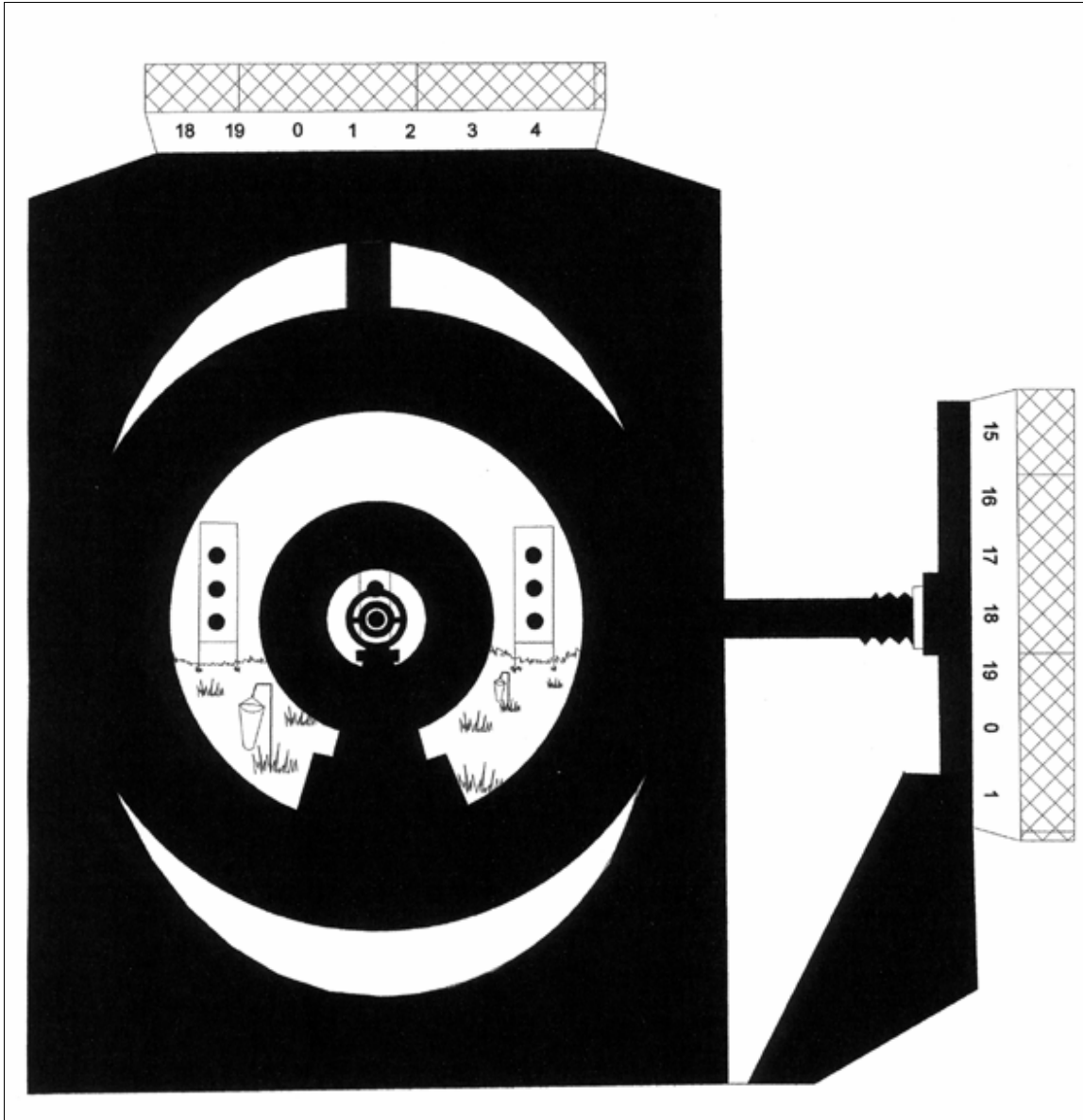


The *Gehmann* wind sight

The *Gehmann* wind sight may look fairly straightforward from the outside but actually using it requires a very different technique. The sketch below shows the view through the sight; the diameter of the ring can be adjusted by twisting the back half of the anti-glare tube, and there's a built-in polariser, which can lighten or darken the area around the ring by adjusting the front half of the anti-glare tube.

The actual ring itself is a tube, making it adjustable like the *Gehmann* foresights, so accurate head placement is essential; if the eye is off-centre the ring will distort and become oval.

Some people may find that the movement of point of impact of this sight is a little too coarse for their liking; it moves between 3mm and 3.5mm at 50 metres, compared with the old *Anschutz* sights which move 2.5mm, and the new ones which move 1.0mm; however, this needn't cause a problem, provided there's no backlash in the sights.



The view through a *Gehmann* wind sight

There's no provision for attaching coloured filters to reduce glare, but included with the sight is an adaptor which would allow you to fit a polariser and/or filter set; however, this would really negate the whole purpose of the sight because it restricts the view to a normal sight picture.

Shooting with this sort of sight will allow you to see wind indicators much nearer to the path of your bullet, and not having to look off to one side so much will help. The sight soon shows you if your head's not central because the back ring goes a peculiar shape, which is quite noticeable.

It will also help you decide whether the flag is pointing directly at you or away from you, something which can be a problem when you're looking at flags out of the corner of your eye.

However, before investing your hard-earned wages, try finding out if any of your club members have one and, if so, how they get on with it; if you're really lucky they may even let you have a go to see how you get on.

The next item which springs to mind is a specialist wind flag. At first glance this may appear inappropriate as personal wind indicators are not allowed in open competitions. However, if you aspire to the dizzy heights of shooting for your country, you may have to shoot under UIT rules, which dictate exactly the size and weight of the wind flags, as well as their location on the range.

If your home range doesn't have UIT wind flags (and very few do), it might be worthwhile getting the specification, making some up and practising reading them in various wind conditions. This is a fairly simply and inexpensive exercise which could help you cope on the big day.

Similarly, making up some windsocks like the ones used by the N.S.R.A., and practising with them beforehand could make all the difference when shooting the Bisley or Scottish national meetings.

As far as club and postal competitions are concerned, the N.S.R.A. rules don't specify what sort of flag should be used, so think about all the possibilities and design a flag which best suits you and your range conditions.

You may find that you pick out some colours easier than others, so experimenting with different colours may help you read the flags better. It's sometimes difficult to decide whether a flag is blowing away from you or towards you, particularly when you're only using one eye, but a two-tone flag could offer a change of colour when there's a change in wind direction.

In America, the bench rest shooters who rely heavily on their ability to read the wind, use a great variety of wind flags (including plastic windmills or swinging pendulums) to indicate wind speed; that may be going too far, but do keep an open mind. Experimenting loses you nothing, and much could be gained by having a wind flag which reliably and accurately allows you to read the wind's effect on a bullet.

The next possible aid to come up for consideration is the extension tube which fits over the muzzle, often referred to as a 'still air tube'. The theory is that the most critical time in a bullet's flight is when it clears the muzzle and is trying to stabilise itself in the first few inches of flight. By extending the muzzle using a larger diameter it's suggested that the bullet is provided with an area of still air in which to stabilise, so that by the time it meets the wind outside the tube it will be stable and less likely to be thrown off course.

It's a theory which must be worth closer examination, so let's take a look at what happens at the muzzle.

While travelling down the barrel, the bullet achieves its maximum velocity of 1000-1100 f.p.s. before it reaches the end. In front of the bullet is a volume of compressed air; it's difficult to determine its size or pressure, but it must be there because air is so easy to compress, and as the bullet accelerates from zero to its maximum velocity in a matter of about 15 inches, it can't possibly push the air out in front of it without compressing it to some extent.

Therefore, the first thing to exit the barrel is a cylindrical volume of compressed air (which contains all the powder residue from the previous bullet) travelling at around 1100 f.p.s. Immediately this air exits the confines of the barrel it expands in all directions until it meets the confines of the tube, when its further expansion is restricted. This effect is going to be slight because the internal volume of the tube is approximately 3.5 times the volume of the barrel, but it's still there.

The next thing to exit the barrel is the bullet travelling at the same velocity as the compressed air, and that will send a shock wave reverberating out into the tube.

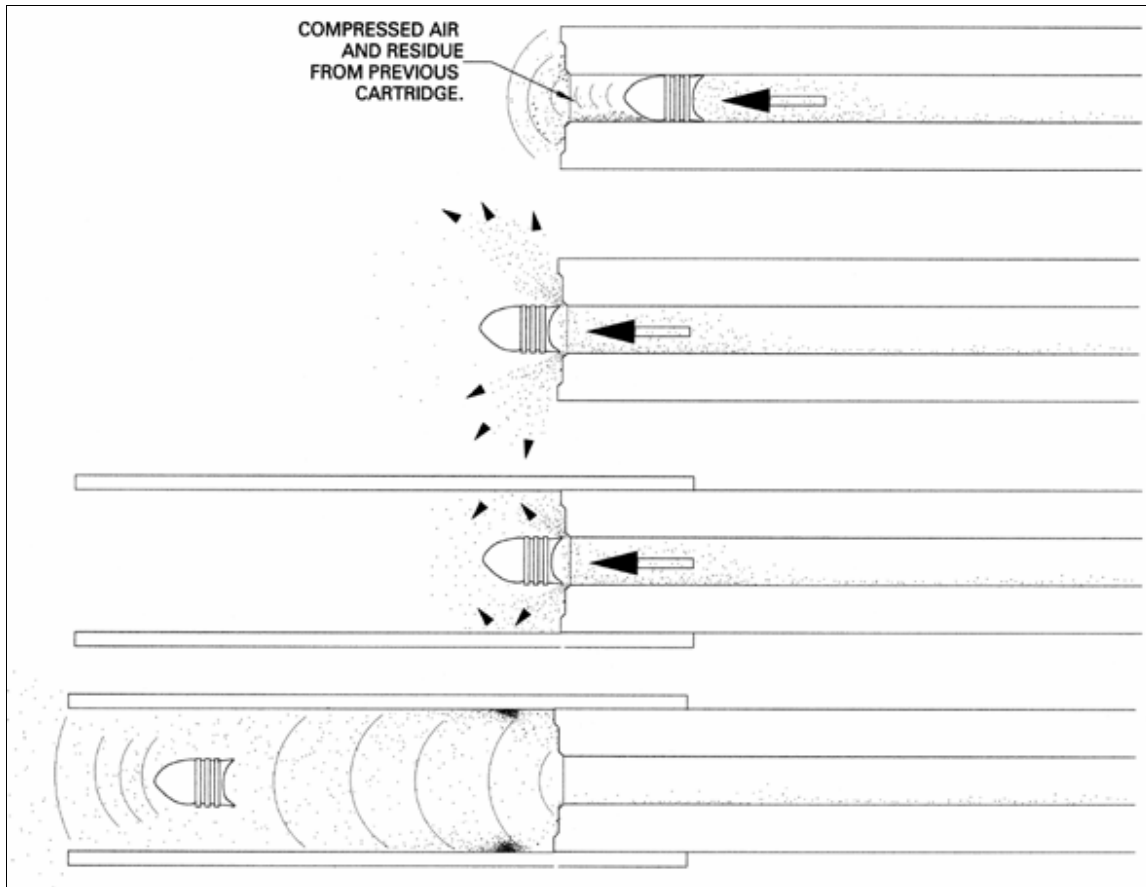
Following close on the heels of the bullet comes a blast of hot gas, and numerous particles which have resulted from the burning of the powder and priming compound in the cartridge case.

The moment the bullet clears the muzzle, it releases the high-pressure gas (which could be at 12,000 p.s.i.) travelling behind it. Because it's lighter than the bullet, it accelerates past it and expands in all directions until it meets the confines of the tube.

Its further expansion is directed down the tube, in front of, and around, the bullet, moving along at its comparatively low velocity of 1100 f.p.s. and slowing down all the time (see the diagrams below).

Because the gases contain solid particles, these will be flying towards the inside walls of the tube; most of them will have enough force to stick to the inside, but some may not, and these will be directed back into the path of the bullet. The tube walls will gradually build up a coating of residue from every bullet fired, without the benefit of the cleaning process which goes on inside the barrel (where every bullet clears out what the previous bullet left behind).

The build-up of residue inside the tube *could* be thicker at the back, (although that may not necessarily be the case) but what *is* certain is that it varies with each shot, which is not at all desirable, and which makes a case for regular cleaning of the tube.



A maelstrom of hot turbulent gases surround the bullet in a tube

So, far from the bullet being launched into still air, it is in fact being launched into a maelstrom of turbulent gases and particles, all trying to get past it and out into the open air.

Knowing that ammunition manufacturers test their ammunition by firing it down a tunnel, perhaps the theory is that the tube acts like a small tunnel; however, it would need to be considerably larger than the barrel, in fact it needs to be large enough to allow the gases to expand away from the bullet without being redirected back into its path.

If we examine what happens at the muzzle *without* a tube extension, it's fairly obvious that all the same things still come out of the barrel, but they're expanding in all directions *away* from the path of the bullet and very rapidly dispersing into the atmosphere.

The gas emerging from the barrel is going to be at a pressure of anything up to 12,000 p.s.i. Compare that with a 10 m.p.h. wind exerting a pressure of 0.65 p.s.i. on the bullet and you can see that, for the first few inches of the bullet's flight, it will be cocooned in a high pressure area expanding outwards, overcoming any disruptive influence of the outside elements, and by the time the pressure from the wind is greater than the dispersing pressure from the gas, the bullet will be well on its way to becoming stable.

All this doesn't particularly prove the case for or against extension tubes; the point about this - or any accessory which you can add to your rifle - is that, if it works for you then use it, but don't just accept blindly that the latest accessory will make you shoot better.

The only real way to find out whether the still air theory works is to 'bench rest' the rifle to remove as much shooter error as possible, shooting groups with the tube and without it, using the same ammunition.

So far, the main accessories available as 'mechanical' aids to shooting in the wind have been covered.

However, there are others which play a lesser role: for example, a telescopic sight can help you to learn how to shoot in a wind. These aren't allowed in most competitions, of course, but for practice there's a lot to be learned from a scope sight. It's amazing how easy it is to aim off in a wind when you can place the crosshairs on the target, and the confidence gained by aiming off with a scope could help you gain confidence with your iron sights.

It's been suggested that some batches of ammunition may 'buck' the wind better than others. There could well be something in that, because the wind deflection formula relates to the velocity of the bullet passing through the air; therefore, as batches vary in velocity it's possible that one batch may perform better in a wind than another.

The problem is that the batch which performs best in the wind may not be the batch that produces the best group size through your particular barrel, as this is often velocity-related as well, and the two requirements may not tie up.

If you have access to a test bench, or even just a heavy table which you can rest on, this can be a tremendous aid to learning how to cope with different wind conditions. By using the table to remove shooter error you can practise reading wind flags and seeing what effects the different wind speeds and directions have on your bullets.

Usually it comes as a surprise to learn that the wind doesn't have as much effect as you think; it might be responsible for the odd 'nine', where a shot's crept out of the bull, but rarely is the wind strong enough to push a shot as far out as the '7' ring, unless you totally misread a wind reversal, or unless a gust hits the barrel just as you're releasing your shot.

To sum up, then, all these things are worth investigating; find out from fellow club members what they think, use other people's experiences to reinforce your own and, above all, remember that it's important to keep an open mind.

CHAPTER 17

CANT

In an earlier chapter you were advised to shoot with the rifle canted towards you to keep your head level. It's essential for 3-positional shooters to do that to retain balance, and while balance isn't quite so important to the prone shooter, you still need to keep your head and eyes level.

You use your eyes to tell you where you are in relation to other objects; you also use your sense of touch and feel as well, but when you're standing up your only contact with *terra firma* is through your feet, and the muscles in your feet and legs perform wonderful little push-pull exercises to keep you upright.

If you suddenly see the ground rushing up at you, you know you're falling over, but if it's dark or you have your eyes closed, something else comes into play, i.e. the semicircular canals in your ears.

Strictly speaking these aren't actually 'canals', they're more like little half-circle tubes interwoven with each other in three different planes. The insides of the tubes are covered with thousands of tiny hairs, and the tubes are half-filled with liquid.

While you keep your head upright, everything is in balance, but when you tilt your head over to one side (or, indeed, start to fall over), the liquid moves around the tubes and covers different sets of hairs, which immediately send out messages to tell your brain you're falling over.

If you've deliberately tilted your head to one side, then your brain wants to ignore these signals. However, it can't just switch them off and there are messages flying backwards and forwards up and down your nervous system while your muscles try to react and straighten you up; so your brain says "no, I want my head on one side" but your ears are telling you you're falling over.

All this is going on while you're trying to concentrate on getting a good score.

Standing shooters (whether rifle or pistol) know that, if they put their head on one side to look through the sights, they sway very slightly from side to side, which is not a good idea.

Prone shooters hugging the ground are unlikely to sway, but that doesn't stop all those messages flying around if the head isn't upright.

Every type of rifle has one basic fundamental design fault: you have to put it in your shoulder in order to fire, and your shoulder is off to one side of your body, rather than directly under your shooting eye.



Canting the rifle keeps your head upright

So, with rifle sights mounted vertically above your barrel, you have to move your head over in order to see through them; of course, you *should* cant the rifle towards you to a greater or lesser degree, depending on your physical size and shape.

The idea of canting a rifle is strictly taboo in the full-bore field, but with smallbore shooting there aren't quite the same problems.

Some people are reluctant to cant because they're concerned about the effect it would have on their windage and elevation adjustments, but put your mind at rest - very rarely are you able to move exactly vertically or horizontally on a target by only winding one knob on the sights. More often than not, the centre of the group requires both elevation and windage adjustments to move it into the bull.

There are twice as many positions on the clock face which *aren't* exactly vertical or horizontal (i.e. 9 - 3 or 12 - 6), and most people find that, if they wind their sights up from 50 yards to 100 yards, even with the rifle perfectly upright they have to make some windage adjustment.

So, if you do cant there are just as many positions on the clock face which would require the manipulation of two knobs.

For example, supposing you shoot with no cant and your shot lands in the 'nine' ring at 9 o'clock, then you would just move across the appropriate number of clicks on the windage knob.

But supposing you shoot with quite a pronounced a cant and you know that if a shot lands at 8 o'clock in the 'nine' ring, you only have to adjust the windage knob. Everything works in the same way, it's just moved around slightly, and once you've settled down with a consistent cant, you make the necessary alterations almost instinctively.

In case anyone is wondering why we don't just use offset sights instead of canting, well that would move the centre line of the sights a lot further away from the centre line of the barrel, which would certainly *not* be a step in the right direction. There are now some sight-raising blocks available from the *Anschutz* and *Centra* factories that do have a small offset - about 10mm or so - which would help with the amount of cant but wouldn't eliminate it entirely.

Another reason given for not canting your rifle is that it's more difficult to judge the angle of the cross bars on your foresight elements than it is to keep them horizontal. That, of course, is very true, but if you shoot with plastic elements you won't have any cross bars anyway.

The latest *Anschutz* foresights have a cantable facility built in so you can rotate the tunnel to combat your cant, ensuring that the built-in levelling bars appear horizontal; there's even a small scale on the side to use as a reference point if you're using different amounts of cant for different positions.

Any builder will tell you that if you want to get something level, you use a spirit level and yes, of course, there are a variety of these available to fit target rifles.

Most of them attach in some way or another to the foresight; one actually fits right inside the foresight tunnel itself (actually brought out for the *Anschutz* 1900 and 2000 series rifles, although it will fit any of the *Anschutz* tunnels which are threaded at both ends). It screws into the tunnel and then can be adjusted for whatever level of cant you wish.

The original *Anschutz* level used to clamp inside the foresight tube, although the bubble itself sat on top of the foresight. It was held in place by a screw fixing, and the bubble could be seen through a window at the top, with a peg marking the centre.



Bubbles to help keep your cant consistent

If you have one of the older *Anschutz* foresight tunnels which is only threaded at one end, you don't have a lot of choice in the matter - this is one of the few 'bubble' options open to you. Unfortunately, they are no longer manufactured, so it means looking out for something secondhand.

Although the screw-in type does interfere with the sight picture to a small extent, it's even possible the clamping arrangement of the original bubble mentioned above can be seen inside the tube.

Alternatively, there are other bubbles available, which are held in place by the screw-in end cap which holds the foresight elements in place - nothing shows inside the tube and the bubble appears immediately above the foresight tunnel.

Should you dislike the idea of looking up in order to see your bubble, you may prefer one which is designed to be mounted on the receiver (the middle item in the above photo). This puts it below the foresight, within your field of view, and it doesn't interfere with the sight picture. The level itself can be adjusted while you're in the firing position because it has a small knob on the side which, by using a clever little wormgear system, alters the angle of the bubble.

Therefore, if you get down on a firing point that slopes at a different angle to your home range (or even one which changes its angle of slope the further along it you go - i.e. Bisley), you can alter the bubble while you're actually in the firing position. There is also a locking screw which fixes it permanently in any position you choose.

It does have its drawbacks, however; the first one is that, if you have your rearsight a long way forward you can't actually see the levelling bubble, particularly if you have a low position. However, that's not too much of a disaster if you have a rifle with scope-mounting blocks on the barrel because, with a slight modification, it can be fitted to one of these. All that's necessary is a thin brass shim which will compensate for the fact that the receiver dovetail is wider than the scope-mounting blocks.

The other drawback is that it is very, very sensitive. Small adjustments in the level of cant send the bubble from one end of the tube to the other without stopping in the middle. However, being able to adjust it while in the shooting position is a great asset and may well outweigh the drawbacks. You will have to make up your own mind, but try to borrow one before you commit yourself, because they are fairly expensive.

If you don't find any of the above suitable for your needs, a trip to a good tool shop should produce some small replacement spirit level bubbles which, for £1 or so, could mean that you, with the help of some *Araldite* or similar, can design your own custom-built bubble in just the position you want.

If you decide to take this path, then take a tip - buy two!

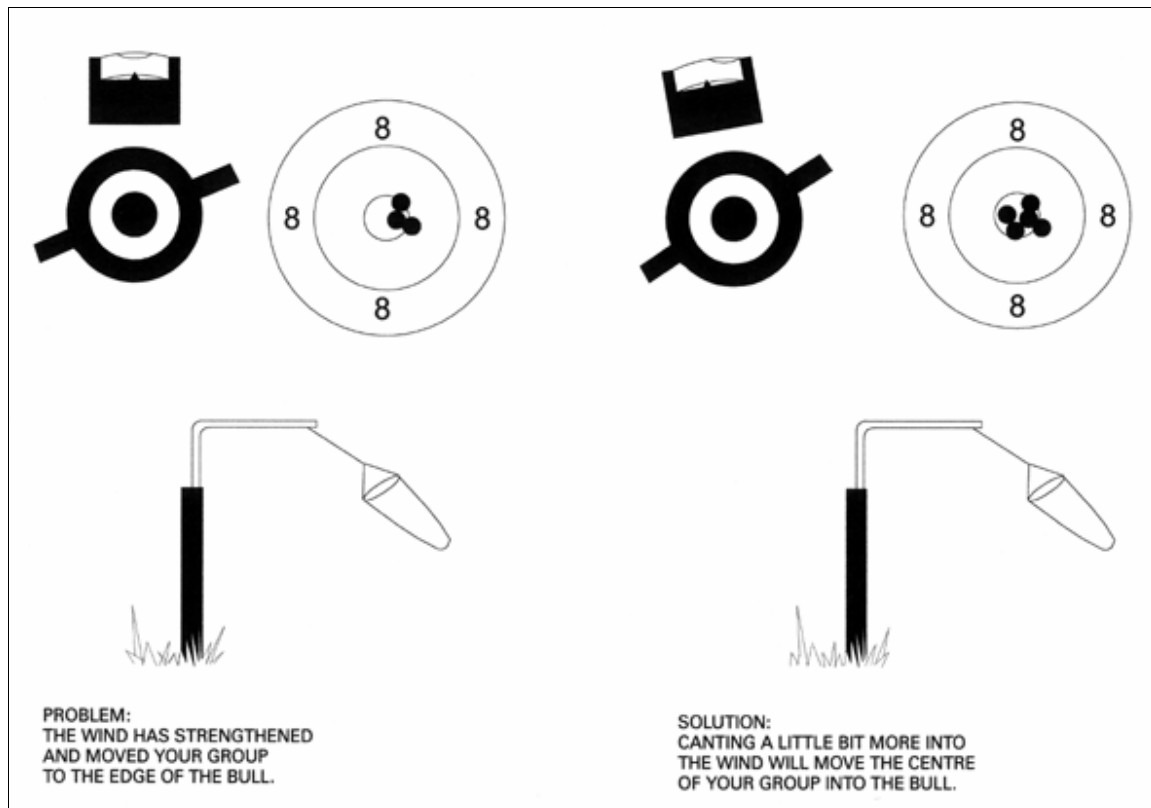
Temporarily fix one with *Blu-tak* to the edge of the sight block or foresight which you intend to use, and shoot with it a few times. *Blu-tak* will enable you to adjust it until you get it at the right angle then, with the rifle on a table, all you have to do is get the two bubbles at the same angle and fix the second one permanently in place. You can then keep the first one as a spare.

Please don't attach it directly to the barrel - smallbore rifle barrels have harmonics and vibrations which could be dramatically upset by something like that.

Whichever bubble system you choose, it can also be a help in a number of other ways, apart from telling you whether your cant is at the right angle and making sure you keep it consistent.

If you reload by lifting your right elbow off the ground (left elbow for left-handers), a bubble comes in useful when returning your elbow to the ground. If the bubble doesn't return to the right place, you know that you've put your elbow down in the wrong place, and you can get back to your correct position by positioning the aiming mark in the middle of the foresight and ensuring the bubble is correct.

Also, if you were reading the chapters about wind and how to shoot in it, you'll know that one of the methods mentioned was to use varying degrees of cant to combat certain wind conditions, such as canting into the wind. That's almost impossible without some means of measuring the varying degrees necessary.



Canting into the wind

With a levelling bubble, it's easy - you could even put extra markings on its glass. Some levels have two marks, which means you can ease the bubble to one side or the other of these marks to get the degree necessary to allow for a particular wind condition.

If you find the idea of having to keep looking at something else other than the target difficult, then you'll have to get used to it; after all, shooting is all about awareness of the prevailing conditions and that includes angle of cant as well as wind flags, mirage, etc.

Don't ask how top shooters manage to shoot as well as they do unless you're prepared to put in the same amount of work as them - these words make it easier for you by giving you some clues on how it's done, but the rest is up to you.

CHAPTER 18

TRAINING

No athlete would be able to compete at the top of his sport without training, but there's more to practising and training than meets the eye, so first of all you need a plan.

If you were a marathon runner all you'd need to do would be to keep running, and that's the attitude a lot of shooters have - they think that all they have to do is keep shooting and it *must* get better; that even works in some cases!

But, the more technical the sport the more things there are to go wrong and, therefore, the more things you have to get right.

Long races ultimately depend on endurance, and the technicalities of a good start are less important, whereas short races are more technical because fractions of a second count, so a 100-metre sprinter will spend a lot of time on his technique.

Imagine a highly technical sport like the shot putt or the discus; you could be the strongest and throw further than any one else in the world, but if you fall forwards out of the circle then your throw won't count and you won't be World Champion.

It's the same with shooting; you might shoot a perfect score but if you take longer than the time allotted for the competition, it doesn't count.

Nowadays sport is very professional and the way to win medals is by technique, and training with the right equipment.

Top athletes spend months on specific aspects of their sport and when each bit is perfect they put the lot together and then go back over the weakest bits.

When you watch the sport on television you're just seeing the tip of the iceberg. When you marvel at how they manage to throw, jump, and run so far, so fast and so high, just think about the hours, weeks, months and years that went into training for that event.

For those of you wondering what all this has to do with you and your shooting, cast your mind over your own training schedule. Do you train six nights a week and compete once a month or is it the other way round; or do you shoot once a week and never train at all?

Do you want to shoot better than you do at the moment?

If the answer to that is “yes” then you must decide how much effort you’re prepared to put in; if the answer to that is “a lot” *where* are you going to put all that effort?

The answer to that has to be “in training”.

Unfortunately most people think that ‘training’ means ‘shooting’, and that’s where so many of you are going wrong; there’s more to shooting than just shooting.

There’s the mechanical side: you have to understand what happens when you pull the trigger.

There’s diet: how many of those athletes at the Olympic Games have a big fry up for breakfast before going out to try to win a medal? OK *you* wouldn’t either, but just remember that anything you eat or drink within two hours of starting to shoot could have an effect on you scores. Wouldn’t you like to know what that effect is?

There’s speed: most people think that shooting is fairly laid back and relaxed but you need fast reactions and efficiency; you have to be alert and able to react to the changes in wind and light, and economy of effort comes from efficiency.

There’s concentration: you must learn to concentrate, and the only way you’re going to learn is by practising. (One of the beauties of television is that you get close-up shots of top sports people, which clearly show the intense level of concentration on their faces when they’re competing).

Then there’s position: you have to train your body to get into the right position every time.

Finally (but by no means least) there's technique: that's all about how you open the breech, how you reload, how you scope your shots, and numerous other things which will all have an influence on your scores. All these things need to be practised individually.

There's no point saying "I don't have time." Of course you do. You have as much time as you want to make.

There are 168 hours in every week; you spend a third of those working and travelling to work, and a third you spend sleeping. That gives you 56 hours a week during which time you have to eat, socialise and generally enjoy life. If you devoted 90% of that time to the pleasures of life, you'd still be left with nearly 6 hours a week for your shooting. Don't waste them!

If shooting is a hobby for you and just provides a pleasant way of spending some of your spare time, this book isn't intended to discourage you from that.

The shooting world is full of extremely nice people who are very pleasant company and the sport is just the catalyst that brings them all together. There's nothing wrong with that, in fact it's something to be positively encouraged as they are the backbone of our sport.

However, this book *is* aimed at those of you who want to improve your scores and who think of shooting as a very competitive sport.

Even if you have no desire to go to the Olympics you could go part way along the trail, just until your scores have reached the level where you're happy with your shooting, so there might just be something here which could add a point to your score. (Even half a point would be useful sometimes.)

The first thing you're going to have to accept is that your shooting is not going to get better on its own - you're going to have to *do* something to bring about an improvement.

You *could* just sit back in your armchair and hope, but do you really think that would work? It might win you the lottery but you aren't going to get any medals that way.

It's all very well droning on about training and practising but what exactly are you going to do?

This is where this book comes in; you can think of it as your own personal trainer. It will help you plan a schedule to get the best out of you, and will guide you through all the things you have to learn.

So the first thing to do is to go out and buy a lined exercise book of A4 size. (You may have one lying around somewhere, of course, but the very act of going out and buying one psychologically gives you a fresh start - this is going to be the new, positive you!) This is going to be a record, a programme and a notebook; you could call it your shooting diary, or your training programme, or anything you wish.

It can be loose-leafed or ring bound or stapled; how thick it is will depend on how long you keep it up, but you can always go out and buy another one if you fill the first one.

You've heard the saying "the pen is mightier than the sword" but there's something much mightier than either - knowledge. You're going to fill your book with as much as you can learn about this sport, then you're going to devise your own personal training schedule and keep a record of your progress.

You'll also keep a record of your scores, so you can enjoy seeing your scores rocket upwards.

Your new book is going to be your 'bible' (so guard it with your life as it will be very difficult to replace), and it will be a great ally in the clubroom as you swap facts and knowledge with other club members.

Notice the word 'swap'. If you ask a colleague a question and you get an answer, it would only be fair to give them, in exchange, some little titbit of information that they may not know.

Now you have your book and presumably something to write with, you can start thinking about what you're going to put in it.

Divide the book up into sections; suitable headings might be (in no particular order):

- Knowledge
- Training/Practice
- Shooting Record
- Miscellaneous

These are fairly broad headings and could quite easily be broken down further. For example, *knowledge* could be divided into history, rifle, ammunition etc.; *training* could be shooting and fitness; *shooting record* would be more useful if you separated your competition shooting from practice, and *miscellaneous* could be anything else you think it worth keeping a note of, such as diet, medical facts, drugs etc.

If any of you are wondering how all this writing is going to help your shooting, read on.

It is important to know as much as you can about what it is that you're trying to do, hence the emphasis on knowledge. The more you know about the subject the more you'll know about how to improve your scores.

This may all sound a little bit like going back to school, which may put some of you off the idea, but you could find that what you learn is very interesting.

If that turns out to be the case, you'll be able to have interesting conversations with all sorts of people, and if some of those people are at present non-shooters, who knows - you may convert somebody!

There is a general lack of knowledge about smallbore target rifle shooting amongst the public, and one of the reasons for that is our reluctance to talk about it, so by knowing a few interesting facts you could stimulate some debates amongst your friends and workmates.

Now let's get to work.

Let's start with a series of tasks, which we'll make as interesting as possible, and which you can adapt to suit your own way of working.

If you can find six hours a week for training, this journal can go towards those six hours (so you *could* be working on your shooting without leaving the comfort of your armchair).

Task No. 1 is to find out as much as you can about your sport and enter it in your journal under the heading of *knowledge*.

So the first heading might be 'history'. How much do you know about the history of smallbore target rifle shooting?

When did it start? Who was responsible for the formation of the rifle clubs you all belong to? What was the N.S.R.A. called before it was the N.S.R.A.? How long has smallbore rifle shooting been an Olympic sport? How many rifle clubs are there in this country? How many were there in the 'Fifties?

Imagine for a moment that you're a television reporter who has to interview a rifle shooter; what questions would you ask that would interest your viewers?

If you're reading this in the clubroom ask your fellow club members a question and see what they know, (but be warned - they may ask you something back!)

Some of the questions should be difficult- there's no point in asking something that everybody knows the answer to - but there's no time limit and there are lots of sources of information.

You could try asking some of your older members what they remember of shooting in the early days; you could try your local library or look up 'shooting' on the Internet.

Try the N.S.R.A., they're *your* Association and they have a great and long history, and don't walk past a secondhand bookshop without going in - they may have some of the older books on this sport, which have long been out of print.

Nothing has to be done in any particular order and if something you discover takes you off on a different track which you find interesting, then go with it, just as long as you're increasing your overall knowledge of your sport.

You probably know that the British Long Range Championship is decided during the 'Roberts' final of Bisley Week, but who was Earl Roberts and what did he do for shooting? (You probably wouldn't have found history so boring at school if it had been about rifle shooting.)

The next heading under *knowledge* is 'rifle', which covers a broad list of things, but basically you should try to know everything there is to know about your rifle.

You could argue that you don't need to know how to change a spark plug in order to drive a car and that's obviously true, but if you *did* know, having to change a plug when something goes wrong wouldn't cause you any major difficulties.

The same applies to your rifle; while they don't tend to break down on motorways, they do have a tendency only to go wrong when you least expect it *and* during a big match! Being able to strip the bolt or action apart because you've done it before, will help when you're away at a match and don't have anybody to do it for you.

There's no suggestion that you need to obtain a degree in Mechanical Engineering, but some basic fundamental knowledge of how the whole kit and caboodle works is essential.

You could start off with some fairly easy questions like:

- how much does your rifle weigh?
- how long is the barrel and what is its diameter?
- how many grooves and lands are there?
- how many times does the rifling turn in the length of your barrel?
- what is its proof pressure?

You owe it to the sport to know every thing there is to know about the piece of equipment that you're using; it's not just a lump of inanimate wood and metal, it's the thing which is going to earn you your gold medal.

Imagine yourself on the television, answering questions on your sport - would you know all the answers to the above?

How much do you know about the ammunition that you use?

How much do your bullets weigh? (the little grey lump of lead, not the whole cartridge) - you probably all know that it's 40grains, but what are you going to say to that Television Person when they ask how much that is in ounces?

If you start thinking about what you *don't* know about your sport, you'll be amazed at how little the average shooter knows about how all their kit works. If you don't believe it, just hold a quiz night down at your club one night and see how much (or little) you *all* know.

If you've never seen how your ammunition is made, contact your local ammunition factory and see if they'll take a group of you round their works. You're quite likely to get a sympathetic response because they'd like you to see the trouble that they go to, to get you the best ammo that they can.

Does your rifle prefer fast or slow ammo? If you don't know that, you'll have to do an awful lot more testing to find out what suits it. What is *fast* and what is *slow* anyway? Is 1060 fps fast or slow?

It would be easy to go on and on asking questions, but it would be impossible to list every question (you'd probably get bored reading them anyway) and the idea is get *you* to ask the questions. It's *you* who'll benefit from knowing the answers.

You don't have to do it alone - there are going to be other people in the club who are interested in the answers; in fact exchanging information can be part of the fun.

You'll never find all the answers because some questions don't actually have an answer but some questions will open up a whole world of opportunity for debate in the clubroom on these long cold winter evenings.

For example you could discuss whether faster or slower ammunition is affected more or less by the wind, but remember - before you come to a conclusion you'll need to produce some evidence to support your theory.

The whole sport is about questions and answers and the person with the most answers is the winner, even if they didn't know they knew the answer.

In the meantime here's some to be going on with:

Why are our bullets covered in some form of grease or lubricant?

Does it matter if the soft lead nose of your bullet is damaged?

How much does a standard subsonic .22 target bullet drop over 100yds?

Why do we call a ten a bull?

How many shots are fired during an Olympic Final?

When?

What?

Why?

Training and practice are two words that strike fear and trembling into the heart of the average rifleman, particularly the first word, but before you go off with your head in your hands, groaning that it's all too hard, here's some words of encouragement:

Training is a very personal thing; what suits one person doesn't suit another, so your training should be exactly tailored to match your attitude and life style.

There are some books which expound the theory that you must be superbly fit to succeed at *anything*; obviously anybody entering the London Marathon without some form of previous fitness training is asking for trouble, but shooting is different.

The fitter you are the easier shooting becomes, but there's 'fitness' and there's 'fitness'.

Some people are naturally fit, principally because they have the sort of body that makes keeping fit easier, i.e. they're not overweight, they don't eat too much and they only drink in moderation. Unfortunately shooting tends to attract the *other* sort of body: overweight, eats too much and drinks more than moderately!

But all is not lost - don't give up hope - however unfit you think you are, things *can* improve, with very little effort.

For those of you who think that even the minimum of effort is far too much these words are aimed at you - you don't know how easy it is to get a little fitter and thus improve your shooting.

There's absolutely nothing wrong at all in being a 'couch potato' but if you *want* to improve your shooting, you're going to have to get up off your backside - at least figuratively, if not actually.

This book cannot lead you by the hand and drag you out on a cold wet night to go jogging and that's not the intention. The object of these pages is to give you the guidance to help yourself, and to make you *want* to get fitter.

It doesn't have to be hard or painful - shooters do not cross pain barriers, it's not in their nature.

Let's consider the top of the tree for the moment and assume that you would like to go to the Olympics in six years' time. You may already be very fit - either naturally or because you also take part in some other sport - but that may not be the sort of fitness you need for shooting.

So, it's important to sort out what type of fitness you *are* going to need, before you don your designer tracksuit and jog off round the local park.

Hopefully you will have noticed that rifle shooting involves carrying a lot of kit around, which can get pretty heavy at times. This means strength is a major advantage - you don't have to be a champion weight lifter, but overall body strength is useful.

Also shooters tend to fire more than just the odd shot every so often, so 100% effort has to be maintained over the whole course of fire, therefore stamina is vitally important.

Your pulse beat is directly transferred to the rifle through four contact points, which means you can't hold a rifle *totally* still, but reducing this pulse beat reduces that movement, and getting fitter could reduce your pulse beat.

One measure of fitness is how quickly your heart rate returns to normal after exertion. In shooting it would be an advantage for your heart *not* to take half an hour to return to normal after you've just carried all your kit from the car park to the firing point!

In general terms, being fit stops you getting tired so quickly, and tiredness affects your eyesight; it also affects your ability to concentrate, so the fitter you are the longer you'll be able to maintain that concentration.

If you're on your way to the next (or next-but-one) Olympics, you're going to have to start training now, and there are hundreds of people out there all willing, and able, to help you.

The first thing you need to do is find an expert in fitness and training. They are plentiful and most towns have a Gymnasium (they're probably all called 'fitness centres' now) which you can join.

Joining a fitness club is probably going to cost you money, but the range of facilities available is usually very good, (nobody said it *wasn't* going to cost you anything!) A club will have experts on hand who can tailor a training program to suit you exactly so it will be money well spent.

These clubs are equipped with an amazing range of machines, all designed to increase your fitness in a comfortable way, and with the minimum amount of effort on your part.

The main emphasis should be on aerobic fitness, because you need a large heart and lung capacity for shooting, but discuss your requirements with the experts and they will know how to get the best out of you. Six months of regular attendance at such a club can have a magical affect on your overall fitness.

For those of you at the other end of the scale who lead a very sedentary life and have absolutely no intention of doing any work towards improving your shooting, here's some good news.

You don't even have to get up out of your armchair to add points to your score. In fact just the opposite - you don't have to lift a finger. You can train by doing absolutely nothing. (Shooters all over the country are now saying: "that's more like it".)

What you have to remember is that your body has a capacity to do a certain amount of work before it needs rest and refreshment.

Think of your body as a car for a moment - it will run for so long on the fuel that you've given it, and then for a bit longer on the reserve tank of fat you keep stored on your person.

That fuel is turned into energy to move muscles, which in turn allow you to go shooting.

If you normally get home from work, have some tea and then collapse in the chair for the rest of the evening, on the night when you go shooting, you're asking more of your body than it's used to providing.

Therefore, on that particular evening you need extra reserves of energy, or you need to reduce what you normally do during the day to compensate.

Most people have bosses who would find it very amusing if you were to ask to forego offloading a forty ton lorry that's just arrived, because you're going shooting that evening, but those of you who *are* able to arrange your workload might like to try arranging things so that you have a relatively easy time during the day.

That can be impossible sometimes and *Sod's Law* dictates that your club night will always be on your busiest day, but if you give it some thought there may be something you can do to help yourself. Therefore, if you have a job that allows you a bit of flexibility, try to have a relaxed day without too much running around before you go shooting.

The worst scenario would be rushing around all day, leaving work late, thrashing through the evening rush hour traffic, beating your head on the steering wheel in frustration, bolting down a heavy meal and then dashing over the club to take part in a team shoot. (It's quite exhausting just reading that).

So if that's the *worst* scenario, imagine how you could improve on it, and then arrange your day as best as you can to avoid the problems.

(For those of you trying to work out what all this has to do with your training, then bear with me for a bit longer, this *is* relevant.)

It's your *mental* attitude which accounts for so much in your shooting, and by taking notice of what you do off the range you can help yourself on the range.

Your training program doesn't have to mean going out every evening and pounding round the streets in the cold and rain in a desperate attempt to get fit; it can be as simple as just slightly rearranging your life to make things easier for yourself.

Getting your kit ready the night before so that you don't have to rush around on your shooting evening can mean the difference between a 'nine' and a 'bull' on that all-important card.

You don't need me to tell you how to make your shooting life more relaxed and comfortable, but if you put a bit of thought into it along the lines suggested, you'll see the results on the cards and you'll have hardly lifted a finger to do it.

For those of you actually prepared to put some physical effort into improving your shooting, this is where you need your shooting journal.

You need to draw up a training program, so writing it down in your journal gives you goals you can see, and enables you to keep a record of your progress at the same time.

You may not feel ready for the Olympics just yet, but a fitness club can still help you, by providing:

- (a) the discipline of going to the club,
- (b) the competition of keeping those weights moving when somebody else is watching, and
- (c) the camaraderie of belonging to another organisation

In those circumstances your shooting journal is kept for you, because your club records will show your progress - all *you* need to do is keep a note of your resting heart rate at regular intervals.

An hour in the gym twice a week will reduce your resting heart rate by 10% in six months, if you specify that's what you want to do when you join, and that level of reduction will have a noticeable effect on your shooting - so what are you waiting for?

Modern lifestyles encourage people to be unfit and overweight: transport is so easy these days that you don't have to expend any energy getting to work or going shopping; even entertainment is brought directly into your home - you don't even have to walk down to the cinema to see a film.

This all means that you have more energy for work, so you can produce more and therefore earn more; then, however, you're too tired to go out and don't have the energy to enjoy your leisure time.

But if you eat and sleep to provide you with just enough energy to go to work, *where* are you going to get the extra energy from to go shooting?

How many times on a cold winter's evening, with the rain lashing at the windows, have you found an excuse not to go to the club after a hard day's work? It can be all too easy to find an excuse *not* to do something, when it requires effort on your part.

Getting fitter will give you spare energy for the leisure times in your life, and being fitter would improve your scores, so what have you got to lose?

On the other hand, lots of you would point to a top shooter who was apparently very unfit and say if he/she can shoot that well then *I* don't need to be fit.

There are two comments to make in response to that: firstly, exactly *how* unfit is that top shooter? They may not appear fit but they may have hidden resources of stamina that you don't know about.

Their job for example may be physically demanding, or they may take part in other sports (or perhaps they used to) or their body size may make them more naturally fit.

If you were to ask, most people would emphasise how unfit they are because they relate fitness to athletes, but you don't *have* to be at that sort of level.

The second comment is that if the shooter concerned really was that unfit, perhaps they would shoot even better if they were fitter.

There are exceptions to these rules, of course; there will always be a short overweight shooter with a very sedentary occupation who will outshoot the rest, but exceptions prove the rule (whatever that means).

It would be nice to be able to tell you that increasing your personal fitness by 10% will increase your scores by an equal amount, but you'd know that wasn't true, because life isn't that simple.

There will definitely be an improvement, but exactly how much will vary from person to person, and obviously the more unfit you are the more benefit you will get from any improvement.

It's possible to get fitter without any major changes in your lifestyle, so let's look at a few suggestions see if you can find one that would fit into your lifestyle with the minimum of change.

The human body is designed for walking - it's a natural thing to do and most people don't do enough - but how many of you get the car out to go to the newsagent for a paper? The car is so easy and convenient, but it doesn't help keep you fit.

Try walking instead.

Buy a dog that needs plenty of exercise and take it for good long walks; some of the fittest people around walk the legs off their dogs twice a day.

Try leaving for work half an hour earlier and parking further away and walking the rest of the way; parking in the firm's car park is terribly convenient but does nothing for your health and fitness.

Even gentle strolling is good for you but obviously the harder you walk the more benefit you will get.

How far and how hard you walk is down to you; if you're not used to walking then take it easy at first, but after a while, if you're walking every day, you'll be surprised at how quickly you can speed up without getting breathless.

Breathlessness is a measure of how you're progressing: if you walk at a pace where you can just manage to talk out loud but are too out of breath to be able to sing, then that's about the right level to do you the most good.

It won't be long before you find that, instead of arriving at work out of breath, you arrive feeling invigorated and ready for whatever the day has to throw at you.

Even after a hard day's work, the walk to your car can make you more alert and will clear your mind of all those distracting work problems (a side effect to that is it could also make you a safer driver).

If you work in a large office block try taking the stairs instead of the lift; *then* try running up those stairs. Colleagues may think you're crazy but stair climbing is a great way of getting your heart and lungs working, and that's definitely going to be good for you.

Try going for a brisk walk in your lunch hour - you can walk quite a long way in an hour.

Even people forced to sit in front of a VDU all day can do things to help themselves. There are statutory guidelines about giving your eyes a break at regular intervals, so use those breaks to do some stretching exercises and go for a brisk walk somewhere.

If your profession forces a sluggish lifestyle on you, you're going to *have* to make space in your spare time for some sort of activity if you want to improve.

You don't have to join an expensive health club in order to get fitter; just running up and down your stairs at home will raise your heart rate in the short-term, but lower it in the long-term, and if done regularly it will soon increase your fitness.

A word of warning at this stage: if you're over fifty or have any long-term medical condition, please consult your doctor before undertaking anything strenuous. If it takes you longer than half an hour to recover from your exercise then you may be doing too much.

Just slow it down for a while. If anything causes you any sort of pain which doesn't go away the minute you stop, then consult your doctor. You're trying to get fit, not kill yourself.

The whole point of exercising to get fit is to keep pushing yourself that little bit further every so often, and then you'll find that you can go further for longer. Just keep pushing your limit a bit further away but do it gradually over a comfortable period of time.

If, for example, you find that it takes you exactly half an hour to walk from where you park the car, you should find that after a week or so you'll be able to manage that distance in twenty-five minutes without straining. In a few more weeks you'll be able to knock another five minutes off, *then* you'll start to notice the benefit.

Buy a bicycle. If you don't want to spend hundreds of pounds on one of these fancy mountain bikes, get a secondhand one out of the local paper. Then use it.

You'll be surprised how much exercise you can get on a bike, particularly if you live in a hilly area; cycling is an all-round exercise, but it's particularly good for the heart and lungs, which is what you want.

Swimming is even better exercise, because pushing against the water provides shock-free resistance.

Within six weeks of taking up one of these options you'll almost certainly see a difference. The most noticeable will probably be a reduction in your resting heart rate, so get used to taking your pulse. Exercise will raise your pulse rate at the time, so only take it when it's settled down and you're resting.

You should also start to get a general feeling of well-being; you'll feel less tired and have more spare energy for doing those things you've always said you'd do, if only you had the energy.

Feeling less tired when you get to the range will help you concentrate more on your shooting, which in turn will help your scores.

Many years ago there was a programme on the television where athletes from all different sports competed against each other at a series of energetic games.

Most people were amazed at the fitness of Jackie Stewart, the racing driver, who regularly beat people whom you would assume were much fitter, because of the particular sport they did.

Jackie explained after one of these programmes that, while he spent all his time sitting in the cockpit of a *Formula One* racing car, he needed to be very fit in order to maintain the extremely high level of concentration needed during a two hour race.

That's why shooters need to be fit - shooting is all about concentration. If you get tired half way through a match, your concentration will lapse and your scores will suffer.

Another thing essential to shooters is suppleness. As you get older so you lose some of your natural mobility and flexibility, and you need to do a bit of stretching to get it back.

A few simple exercises will help; they don't have to be much - just a few neck rolls, a bit of back stretching from side to side and waving your arms about a bit just to keep those shoulders loose. Tension very often shows up in the shoulders and will affect your group size, so by keeping them loose and supple you'll help reduce that risk.

This book isn't designed to be a fitness manual - there are plenty of those available in your local bookshop. Browse the bookshelves and see what catches your eye and appeals to the level of fitness *you* want to achieve. Lots of books will turn you into an Olympic athlete in a matter of hours (or so they claim) but that's not what you want.

You want a book about gentle aerobics to improve your metabolism; two which seem to be readable and informative are:

"Fit for life" by Ranulph Fiennes.

"Fitness for Dummies" (1999 - Transworld Publishers).

The first book is written by an incredibly fit individual who dragged a 500lb sled several hundred miles across Antarctica at 52 years of age; the second is written seriously, but in a light-hearted easy-to-read fashion.

Happy exercising - but don't overdo it.

RIFLE TRAINING

After extolling the virtues of training in the *physical* sense, now is the time you should be thinking in terms of training with your rifle. In other words actually doing some shooting which is not competitive.

For those of you who find that they only have just enough time to do their league cards, let alone any others, I have every sympathy, but this book is about helping you to shoot better and that *will* involve a certain amount of training.

You could argue that you could use some of your competition cards as practice. Some top shooters do use their league cards to practice for bigger competitions, but you need to get away from that idea, because it's not fair on those team members who put 110% effort into their league cards.

Training should encompass *everything* you do to improve your shooting, and one of the reasons for having a shooting journal is to keep a record of your training schedule.

It's the aim of every sports person to have their own coach (in modern parlance they're probably called 'personal training supervisors') who will look after them, train them, keep them to their schedule and tell them how wonderful they are. However, in the shooting world personal coaches are somewhat few and far between, so you're going to have to be your own coach.

Try thinking of yourself as a shooting machine. Imagine yourself to be a robot whose sole purpose is to lay there, holding a rifle, and to release the trigger at exactly the right moment.

Then imagine yourself to be in charge of that machine, controlling it and guiding it as it shoots.

Now you can be your own trainer. You can map out a training schedule and make your machine go training even when it doesn't want to. You can make it practise the things it's not good at until it gets them right.

At this juncture it's important to realise that coaches don't possess some magic formula that they pass on to top shooters to make them Olympic champions. Top shooters become champions by hard work, all the coaches do is keep them pointing in the right direction.

One of our Olympic shooters was ostracised by his own club because, when they asked him for his formula for shooting so well, he told them it was all just hard work and practice. They didn't believe him and were convinced that he was privy to some secret knowledge disclosed only to top shooters.

On another occasion an Olympic coach visited a club to help them with some individual coaching. One of the members complained afterwards that 'he didn't change anything', as though the coach was going to rebuild his position into a medal-winning one and he would be a champion immediately.

It has also been known for people to turn up to a National Squad training session, expecting to be magically turned into this country's greatest shooter overnight.

There is no intention to decry the work done by our coaches in the UK - they work very hard for little reward, and there are too few of them; the point is that there *is* no magic formula and, therefore, there's nothing to prevent you from becoming your own coach.

You could make yourself shoot better. You *can* train yourself.

However, don't be tempted to go on one of those excellent courses run by the N.S.R.A. to train coaches, with the intention of helping yourself; that's not their purpose.

If you do go on a course to learn how to be a coach - which after all is all about communication - then you should be helping other people, not just looking for tips on better shooting.

Just imagine for a moment that you *were* training somebody else. How would you go about it?

How would you get them to shoot better than they do? It would be very easy to say that you haven't got a clue, but just think about it for a moment. Does that person do enough training? Do they practise enough? What are their weak points? Do they have the right motivation? Do they want to win?

Now apply those questions to yourself.

It would be very easy at this stage to give up and say that all you want to do is shoot better than you do at the moment, so "who needs all this motivation stuff?", and "what's on the television?"

You don't have to decide to go the whole hog straight away, you could just try it for a while and see how it goes, and if a little bit of work produces a result then you might get tempted to go a bit further.

It's *got* to be worth trying one or two things in case you hit upon something that works for you which suddenly puts a few points on your score. Unfortunately there's not one particular thing that can guarantee putting points on your score, it could be a combination of things.

This is another reason for the shooting journal you're keeping - it will help you highlight those things that appear to improve your shooting.

However - back to the shooting robot mentioned earlier. One easy way of improving its shooting is to identify which things it's not very good at, and work on those. You have to be careful here to make sure that you don't practise just one thing to the exclusion of all the others - just increase the amount of shooting you do, which concentrates on your weak points.

Suppose your robot is not very good at shooting in the wind. The coward's way out is to only shoot on calm days, and if you're shooting in a team, then that's obviously going to be best for your team.

However, what would be even better for the team is if you learnt to shoot in the wind and then, when you didn't have any choice about when you shot, you'd still put up a reasonable score, even in a gale.

Now you're in charge of your 'other' self you can *insist* on more visits to the range to practice shooting in the wind.

Watch the weather forecast (and remember that the middle of the day is usually the windiest), then compile a course of fire for your robot to shoot.

You'll still have to take yourself up the range and get all your kit out for yourself, but once on the firing point you become the coach, watching the wind and telling this machine of yours when to pull the trigger and when not to.

When you've finished a target, discuss it with your 'pupil' and analyse their shooting. Question yourself about why that shot went out in the 'eight' ring and why that one went in the 'bull', and make your pupil write down the results of the shoot in their journal.

If you had a personal coach standing over you while you shot, he would probably be asking you questions about what you felt, what you were thinking, and why you did what you did.

He would be trying to get you to think about what you were doing and why you were doing it. *You* would probably make up a few lame excuses about why you thought that shot went in the 'eight' ring, but if you didn't also know why the shot went in the bull then they *are* just excuses and your coach would know this.

You *must* be critical of your shooting self. It's a lot easier now because you have a pupil whom you've created, and you can be a lot harder on him than you would on yourself.

This technique can be applied to all the other things that your robot isn't very good at, like 'aiming off', or shooting too slowly.

When somebody was asked once (when they had run out of time on a windy detail) why they hadn't aimed off and they said they couldn't do it. When asked why not, they said because they'd never done it.

If your robot can't aim off, get it up the range, wind its sights off by twenty clicks and make it shoot a card. Just doing it isn't going to make you an instant expert, but the more you do it the more you learn about doing it, and the easier it becomes.

If you were actually coaching somebody else it's quite likely that, when you told them to do something they would ask *you* how to do it, so you'd have to learn all about it before you could teach somebody else.

That's how it's got to be for you; if you're coaching yourself, you must investigate the things you don't know anything about. Talk to other shooters, listen to how they aim off, and listen to how they shoot in a wind. Which flag do they use, and why? What size foresight do they use?

It was said earlier that coaching is all about communicating, i.e. the coach talking to the shooter, but there's more to it than that; you also have to be able to communicate with other people so you can learn things you can pass on to your pupil.

If you don't know something, you should ask someone, and if the person you ask doesn't know either, then there are two of you who need to find out!

PRACTICE MAKES PERFECT (SOMETIMES)

Nobody goes smallbore target rifle shooting in this country because they have to. Of course, club captains can get pretty persistent at times and you may sometimes feel pressured into doing cards, but that's part of the sport.

Imagine the agony of being a marathon runner in the middle of January, knowing you *have* to run so many miles every week. Having to shoot an extra card for your club pales into insignificance compared with what you might have to do in another sport.

The whole reason you're a shooter is because you enjoy it, despite what you might think sometimes. Coming off the firing point after a bad shoot is probably the time you feel you're enjoying it the least, but then you have a good shoot, or do a couple of cards above your average, and you think maybe it's not so bad after all.

Just remember that, if you didn't have bad shoots you'd never recognise when you had a good one.

So if you're going to enjoy your sport then you must learn to love it all - even the bad shoots. Of course, some of you with masochistic tendencies actually enjoy a good moan about your shooting, but don't take it too far.

Look upon your bad shoots as lessons learnt and move on to better things. If you've had a bad shoot it's likely to be because you were doing something wrong, in which case you could use that shoot to work out *what* it was you did wrong, and then make sure you don't do it again.

Think positively!

Now apply that attitude to your training and practice.

The virtues of getting fit and training for your shooting were mentioned earlier, and obviously practice plays a very important part in that scenario as well, but practice is boring isn't it?

How do you motivate yourself to go up the range and practise when it's all you can do to find the time to get your match cards shot?

Ask yourself a question, do you want to shoot better than you do?

Of course you do. You'd love to walk back from the prize table clutching the club championship trophy with the thunderous applause of your fellow club members ringing in your ears.

Even the quick handshake from the club captain as he hands you a team runners-up medal is a rewarding and pleasurable experience.

You *will* shoot better if you practise, but there are two very important things about practising that you should be aware of.

Firstly, you've got to *want* to do it, because if you're there under sufferance you won't do the job properly.

Secondly, practice must be interesting. If you get bored that's as good as switching off part of your brain, and you need all your mental ability in order to learn anything from your practice session.

If you said to the average shooter "go up the range and practise", they'd probably go up the range and shoot some cards without stickers on them, but that's not good enough.

In order to practise correctly you need to have an objective, and you mustn't try to learn too many things at once. It's much better to concentrate on small individual things during practice, rather than just shooting for as good a score as you can get.

Practising shooting doesn't necessarily mean just shooting at a normal target and counting the score. You must have a plan, something you're going to achieve. If you then achieve that goal, that's as good as having a good shoot.

Learning something from your shooting is rewarding, but how can you learn something if don't set out to do so in the first place?

It is all very well saying "I'm going up the range to practise shooting in the wind" - that's very laudable but it's not enough. You need a definite plan, like aiming off, or shooting quickly and waiting for the right wind, and then measuring groups not scores.

Making practice fun will help stimulate your interest, so devise some things to do which are a little different; by way of explanation there are coaching techniques which can be learnt from other sports.

Lots of practising can be fun if it's against someone else. Teachers know that it's easier to get children to run about on a sports field if they're divided up into teams so that they compete against each other. That makes it more exciting.

There's no reason why you can't make your shooting practice as exciting.

Of course you can't start running about on the firing point, that wouldn't go down very well with a lot of people, but you can devise other things to do that don't mean just shooting for a score.

The first thing to do is to find somebody else in your club who is interested in improving their shooting.

Then arrange a few practice sessions on the range together, but set out *in advance* specific plans of exactly what you're going to do. This will stop you standing on the firing point looking at each other wondering where to start.

If other people get to hear about the fun you're having they may want to join in as well, and the more the merrier.

The secret is in the planning and setting the objectives, so there are a number of areas you can look at:-

One of the things that catch people out is shooting too slowly. Really top shooters can shoot very fast because sometimes it's necessary to do so.

Details are timed, so if anything goes wrong (with your equipment, for example) you may find yourself having to catch up, and to be thrown into a panic because you can't take your usual five minutes for a shot will have a disastrous affect on your scores.

Being able to shoot fast but accurately is easy, but you won't be able to do it if you don't practise. Imagine being at an open shoot with five minutes to go before the end of a twenty-shot detail and you haven't fired a shot yet.

Could you complete a twenty-shot course in five minutes? Of course you could, that's almost a leisurely pace. The '*Queen Alex*' shooters have ninety seconds for ten shots so you would actually have a couple of minutes you don't need!

Speed shooting is something you can practise on your own if you have to - just set your timer for less and less time and see how well you shoot. With several of you, one could act as the timekeeper and call out the passing minutes; that tends to increase the pressure, which is also good for you.

You may at first think that as you're allotted twenty minutes to shoot, that's the amount of time that you should use when you're practising, but there are a number of reasons for learning to shoot fast.

Outdoors you need to be able to shoot quickly to take advantage of the right wind conditions, which don't always change at a leisurely pace to suit you.

Or something might happen which means a major alteration during a detail, or the detail has just started when you discover that you've left your bolt in the car boot. (It happens!)

Careful planning can stop some of these things happening, but shooting involves one of nature's major laws: "If something can go wrong it will, and at the most inopportune moment".

Two of you could organise a race, round a target. Award a point for every minute or part of a minute that one person is faster than the other, and add it to the score.

Next try wind coaching.

This takes two of you; one does the shooting the other watches the wind and says when to fire the shot. The shooter acts as a machine and only follows instructions. Then swap places. You'll be amazed at what you can learn from this exercise, particularly if you do it regularly in different weather conditions.

Then try the 'one shot match'. Challenge as many members as you can to a one shot match. If people object to going all that way just for one shot, they're missing the point, but to appease them combine it with some other exercises.

It's fairly self explanatory and you can make up your own rules, but to get you started I'd suggest the following: allow everybody to sight in and then make

them stand at the back of the firing point. At the whistle everybody gets down and fires one shot and then gets up again.

This is best done at 50 metres or 100 yards because there would be too many bulls at 25 yards(!) Ties can be decided by re-shoots until there is one clear winner. You could even add a time limit.

This competition really makes you concentrate on getting that all-important first shot in the bull and makes you get down in the correct position first time.

Next try shooting one shot at each aiming mark on a 50-metre card and keep going round the card until you've put five on each. Then do it again in a different direction and compare the groups and where they are. Does your group always end up in the same place on the same aiming mark? Doesn't that make you wonder why?

Another exercise is to take out everybody's foresight elements then shoot a couple of cards; you'll be surprised at how well some people will shoot, and so will they.

You could make everybody shoot with club rifles and keep swapping them around. You could make them all shoot without spotting scopes and just judge them on the smallest group.

If you have somebody in your club who is a wizard on a computer then persuade them to design and print up some different-shaped targets. Try squares and ovals. You don't need scoring rings - just work on group size. You'll be amazed how a different sight picture makes you concentrate.

These are just some ideas, and all of them will teach you something, whether it's about wind behaviour, how fast you can shoot, or getting down in the right position. Now you can start thinking about devising your own practice routines.

It doesn't take much imagination to work out something which is different, fun and interesting, and you could be pleasantly surprised at the results. You could even devise your own unique competition.

Cut the centre out of a 50-metre aiming mark - just inside the 'nine' ring - and get people to see if they can put twenty shots through the hole. If you think people might cheat (heaven forbid!) then mount a backing card far enough behind to separate the shots.

That was easy wasn't it?

Think what all this practice could do for your club. It will generate interest, team spirit, camaraderie, and give the novices something to have a go at without frightening them off. (You could always cut the hole as big as the eight ring or even the seven).

One thing that must be stressed is safety. If you're going to have all sorts of different things going on, please make sure your range officer stays awake at all times. People leaping about all over the firing point can sometimes forget the command "check your weapons are clear".

CHAPTER 19

MIND CONTROL

There are two ways of looking at smallbore target rifle shooting - as a hobby/pastime, or as a competitive sport. Lots of people tend to think that they fall into the 'hobby' group and use their shooting for relaxation - an opportunity to get out of the house and to have an interest in something totally removed from their work.

There's nothing at all wrong with that attitude; it may not be *your* attitude, but never dream of questioning why somebody follows a particular sport the way they do. What people don't realise is that, however much they try to treat rifle shooting as a hobby, it still produces competitive feelings, no matter how hard they try to suppress them.

If this wasn't the case no-one would come off the firing point thoroughly fed up when they've shot badly, and there's no-one out there who could honestly say that they don't experience some feeling of pleasure when they've shot well!

Of course, lots of people get some perverse pleasure from being able to complain about their shooting, and very few smallbore shooters boast about their successful shoots but, in the main, when you shoot well you're pleased and when you shoot badly you're disappointed. This is the whole point of shooting. If you don't care where your shots go, you might as well be using 'blanks'.

The feel of a .22 target rifle going off leaves a lot to be desired in the excitement stakes, so we have to get our excitement elsewhere, and *that* comes from bettering a particular score or average, or beating someone else.

Therefore, despite what was said at the beginning about pastimes and hobbies, smallbore target rifle shooting really *is* a competitive sport but, there are various levels of competition and somewhere in there is a place for *you*.

If you want to shoot better than you do at the moment, you are most certainly competitive and that's a most admirable attitude. However, one thing that troubles a lot of shooters is that they think they haven't got what it takes when it comes to winning Olympic medals.

This applies to a lot of people, but there are still lots of other medals to be won.

Let's suppose for a moment that you've just started shooting; you have all the right kit because you've been reading this book, and now you're ready to take on the world. You look round in your local club and you see lots of people who shoot better than you; your first question should be "why?"

Do they have better equipment? That's possible, of course, but better equipment in the wrong hands gives no advantage.

Have they been shooting for longer? That's also possible as you've only just started, but even without any help of any kind you'll begin to make progress by just shooting (bad habits and all!).

Have they had any coaching? Ask them, and the answer is probably "no". We do have coaching schemes in this country, but they fall pitifully short when it comes to reaching ordinary club members.

Do they have a natural talent? Some people do seem to have a natural aptitude for shooting but it's not like being blessed with perfect pitch and being a musician. An 'aptitude' just might mean that you're interested enough to put some effort into the sport.

That would, of course, explain the case of someone who's been shooting for years and has never improved. That doesn't mean to say, of course, that he doesn't enjoy his shooting, but everyone knows that he'll never make it to the top, and he's quite happy about that.

It's worth pointing out here that .22 target rifle shooting is 90% technique (at the very least) and anybody with the right technique (and the right mental attitude) can make it into the top 10% of shooters in this country. After that there will be something which separates the Olympic gold medallist from lesser mortals, but that still may only be a matter of mental discipline - something which we're all capable of learning. So now we're going to try to look at adopting the right mental attitude.

However this isn't a book on psychology so we won't pretend that there's any medical background to this - it's basically an opinion as to the attitude you should be adopting if you wish to improve your shooting.

There are no complicated formulae or rules, and the word 'must' won't appear very often, because as soon as somebody says 'must', some minds automatically say 'mustn't'! You need to keep an open mind and create a sponge in your brain (some people have these naturally) which is capable of absorbing information.

Think for a moment about Sherlock Holmes; he'd get the vote for being the most boring person to meet at a party, as he'd spend so much time looking at people's shirt cuffs to interpret the ink stains that he'd have no time to be entertaining, but he would have probably made a brilliant smallbore target rifle shooter.

You may think at this stage that this is wandering off the subject, but shooting is a mystery to many people, and there are times when Sir Arthur Conan Doyle could have given us a few pointers if he'd still been around. Try to see if you can train your mind to be as inquiring and absorbent as Sherlock Holmes'.

For someone new to the sport there's so much to be learned from observation; even people who've been shooting for years may still find things they didn't know about, simply by asking, or by experimenting with a new idea.

So, let's go back to the new shooter in the club, faced with all the experts. (If you've been shooting for years, please be patient - there might be something to be learned from putting yourself in the shoes of a beginner for a while).

Keep a notebook with you at all times (if you have a mind like Sherlock Holmes' - or like a computer - you can probably get away without a notebook, but you're trying to improve your shooting, not win a memory contest!). Watch what goes on when you're down the club - most shooters are creatures of habit.

They have set routines that they follow. Ask yourself "why?" Is it because, by doing the same thing every time, they ensure that they don't forget a vital piece of equipment, or are they on 'auto pilot' with their brain working elsewhere? Which would work best for you?

There will always, however, be the scatterbrained club member who does something new or different every time (to the great amusement of the other members), but still manages to shoot well. Could you cope with that, mentally?

Is doing something the same way every time you shoot going to help your shooting? Are you going to be happier working on 'auto pilot' or would you rather think about what you're doing all the time"

Clubrooms can be great places of camaraderie and entertainment, but when you're new to the sport and nobody knows you very well, you might be ignored for a while. This gives you a great opportunity to minutely examine every stitch in your shooting glove while carefully getting your kit ready for shooting, which helps you prepare *yourself* for *your* shoot.

However, after you've done that for a few evenings, your mind starts to wander off on its own; before you know where you are, you're joining in the general clubroom banter and then find yourself on the firing point without a bolt for your rifle, or any ammo, or ... the list of things you can forget is endless.

So, how do you cope with this?

'Auto pilot' is the choice lots of people make, but - be warned - points can easily be dropped in the clubroom before you even get into the range. Shooting is very much a mind game and if you don't go into the range in the right frame of mind you could be on to a loser before you start.

Don't be fooled by some people's casual banter in the clubroom; that's their way of unwinding from a hard day, or their way of getting into the right frame of mind. It's very easy to get uptight before a shoot, particularly an important one, and a laugh and joke in the clubroom first is some people's way of easing the tension.

Analyse what everyone is doing; watch what different people do before they go in to shoot. Do they have routines which *you* could adopt which will help you?

Watch the shooter who's counting his ammunition out into a separate tray and consider why he's doing that. Is it part of his preparation procedure or does he simply find it difficult to use the manufacturer's original box? Or is it because he finds it easier to keep track of the number of shots he's fired by arranging the ammo in a particular pattern in the box?

Remember that smallbore target shooters are the nicest people you're likely to meet, so you're in a safe and friendly environment, and you can relax. Nobody expects anything of you - they're all there to help you if you need it; so if you need to create a quiet routine for yourself, then do it - only a fool would fail to understand.

The shooter who busies himself with his kit and his notebook (and his warm-up exercises) before he shoots is not thought of as being stand-offish; there's plenty of time to be the life and soul of the party when you come out of the range.

Remember that Sherlock Holmes solved most of his cases by observation, and you can learn to do the same. While you're surrounded by better shooters than yourself, observe them, make a note of what they do and ask yourself "why?" But don't follow the top shooter in your club around with a notebook and pencil - it might be better to observe from the other side of the clubroom!

Don't be afraid to ask questions, but do have the courtesy not to interrupt any of the club's top shooters when they're obviously concentrating hard in preparation for their shoot.

If you feel nervous about approaching people that you don't know too well, particularly if you're shy, remember that most of those experienced shooters were in the same position as you at some stage in their shooting career, and would have suffered the same pangs of curiosity and anxiety.

Don't be afraid of making a mistake - someone will have already done it before you (there are very few *new* mistakes in the shooting world). What *is* important is how you recover from that mistake, and don't be slow to apologise if you make a mistake which affects another shooter (such as putting a shot on his card).

However, if you knock the Club Champion's rifle off a table, breaking his stock and bending his sights in the process just before he's about to go into the range to shoot the final of a team knockout competition - *you're on your own!*

If you're lucky enough to have any top international shooters in your club, watch them closely (but discreetly!). You may be reluctant to approach them, but most top shooters are very nice people and really don't mind the polite approach and the interested question (after they've shot).

However, whatever you do, don't assume that they shoot well because they have some amazing secret formula which they want to keep to themselves! They've reached the top by putting in a great deal of hard work, and if you put in the same effort there's no reason why you shouldn't reach the top as well.

So - adopt the attitude that you *can* make it, and you will!

Before you can expect to get to the top you're going to have to decide whether it's you or your brain who are in control. Your brain runs your body very well, and anything capable of looking after such a complex machine deserves a lot of respect. But there are times when *you* should be in charge and you tell your brain what to think about. That's all about mind control.

Smallbore target rifle shooting is a sport which requires a great deal of mind control. Once having learned the basic techniques, it's all about controlling the brain and what it's doing.

So many people struggle for years, desperately trying to learn every technique and buying every accessory that comes along, completely forgetting to control the bit between their ears.

Really good shooters have been let down on the day by their inability to cope with their nerves, or with the pressure from a big match. They may even have lost a match for the sake of a few moments of concentration.

However much effort you put into your training or practice, it's no good if you don't train your mind at the same time.

Lots of people think that there'll be plenty of time for working on their mental attitude once they're on their way and have learned the basic technique but, in fact, it's *never* too soon to teach your brain what you want it to do.

This chapter is going to work through the basic techniques and, at the same time, emphasize *why* what you're doing is so important to your brain.

The first thing to do is draw up a list of *all* your shooting equipment. For someone just starting out in the sport this is essential; your list should read something like:

1. This list
2. Rifle
3. Bolt
4. Sights
5. Ammunition
6. Spotting scope & stand
7. Jacket
8. Shooting lens/glasses
9. Shooting sweatshirt/jumper
10. Sling
11. Glove
12. Hat
13. Ear muffs or plugs
14. Mat
15. Stopwatch/timer
16. Cleaning rod (in case a bullet gets stuck in the barrel)
17. Oil, rag & cleaning equipment
18. Wet weather gear/wellies
19. Bulldog clips
20. Pen & notebook
21. Squadding notice (if going to an open shoot)

22. Tools (to cope with bits coming loose/dropping off)
23. Soft drinks/water
24. Food (if necessary)

Consult your list frequently, particularly before you set off to shoot somewhere - it will do you no good at all if you find that you've left something behind. Mentally you may manage to overcome the inconvenience (providing you haven't forgotten something vital, like your bolt), but it still means that you'll have to give over part of your brain to coping with the problem, instead of concentrating totally on your shooting technique.

If you've checked your list and have everything on it when you arrive at the range, your mind won't be continually trying to remember whether you *do* have everything and, consequently, you and your brain will be much more relaxed.

Over the years that list will probably become a mental one but - be warned - that's precisely the time when you allow your 'auto pilot' to take over, and when something breaks your routine, causing you to forget something.

It has been known for people to arrive at a range without a bolt, or sights, or ammunition. How can you possibly expect to shoot well if you go down to shoot in a panic? *Knowing* that you have all your kit and that you can cope with any emergency, gives you confidence and stops your worrying, which has *got* to be the right frame of mind to produce a good shoot.

So, consider the beginner, hovering in the clubroom with notebook in hand, nervously waiting to go into the range; all the kit has been checked and all that remains is to set it up on the firing point.

The first thing to put down is the shooting mat, but where do you put it?

If you've been watching everybody else, you'll notice that they have a very casual way of throwing their mats down without seeming to pay any attention to how they lay.

However, as a beginner you should pay careful attention to how you lay out your shooting mat. Rifle shooting is about consistency, so you need to place your mat in exactly the same position every time so that you can lay on it in the same way every time.

During your shooting career you may shoot on lots of different firing points in a wide variety of surroundings, so you will need a *datum* point to use as a reference.

The obvious *datum* point is the target, as it will always be there; it may not always be directly in line with the firing point but it is important that you line your mat up with that target, no matter what angle the firing point is at.

The obvious way of aiming your mat at the target is to put 'sights' on it:-

Arrange the mat at approximately 15 degrees to an imaginary line from the target to the centre of your firing point. Now stick some brightly-coloured tape on top of the mat - one piece at the head and one piece at the foot, so that they're on that imaginary line, straight from the target. They don't need to be very long tapes, they just have to be large enough for you to see.

Now all you have to do when you lay your mat on the floor is line up the two pieces of tape with the target and - *Hey Presto!* - your mat always goes in the same place.

Once you know that your mat is positioned correctly all you have to do is lay on it in the same way each time and you're starting off on a consistent basis.

The next piece of equipment you might want to place on the firing point is your spotting scope. Obviously it should always be positioned so that you can see through it easily, but even that requires a great deal of work and experimentation.

The scope should be placed so that looking through it requires the absolute minimum of effort and movement on your part - and that's a lot easier to write than it is to do!

Modern scope stands are built with multitudinous adjustments to allow for every conceivable position, so let's assume for the moment that you've found the ideal position for your scope. Get out your roll of sticky tape again and add some marks to your mat to indicate where the scope stand legs should be positioned (making sure that you don't confuse these marks with the ones stuck on earlier!)

Having got your scope and mat in place, you can scatter the rest of your equipment about in whatever way you find the most convenient. You'll know where to put your ammo so you can reach it easily; the rifle should come to hand quite readily when you're ready to shoot - these are all things which you can work out for yourself. Just remember: "minimum effort and movement".

One important piece of equipment not yet mentioned, of course, is *you*. Once you're down in the right position it would make sense to mark *your* position on the mat. For example, there's no harm in marking where your left elbow goes (if you're

a right-handed shooter) as that's usually what you lay down first when you pick up your rifle.

What you can't see, of course, is how you're laying in relation to the rest of the mat (and therefore the target) and even the smallest of positional differences can have an effect on the pressure which is bearing on the rifle, particularly if you alter it during the shoot. But if you can't see how you're laying, how can you see if you're in the right position?

A camera can be a valuable tool when it comes to analysing your position, so get someone to take some photos of you from all conceivable angles while you're shooting, and compare them with your idea of what you *should* look like.

Using these you can refine your position by adjusting your sling and stock if necessary, until you achieve a flat, comfortable position which you can repeat. As a general rule, if you look ungainly and uncomfortable when you're in the shooting position, your shooting will suffer as well.

Lots of shooters just get down on their mat, pick up their rifle and point it at the target. They may have been told things like "shut your eyes and see if the sights stay on the target" and they may have developed all sorts of personal ways of trying to ensure that they're in the right position, but how do you, as a beginner, learn to do this in a calculated manner?

Firstly, your body is a mass of nerves and senses, at the head of which is a computer capable of assessing unbelievable amounts of information. Use it. Every part of your body is capable of feeling something and your brain is capable of interpreting that feeling. Try this small experiment.

Send your brain off on a tour of your body via its sense of touch. Ask yourself what you can feel in various parts of your body.

Can you, for example, feel your left elbow? Try your right knee; can you feel anything touching it? Can you feel your trousers or skirt resting on it? What you're trying to do is make your brain aware of what you're feeling or touching.

When you're next lying on your shooting mat, send your brain off onto its tour again and see what your ankles feel like, and your knees, and so on up your body to your neck and head.

Teach yourself what you feel like from inside. Remember where your right knee goes - perhaps because it's resting on a fold in your mat you can feel it. Notice what your

right elbow feels like because of where it is on the mat; it's not easy because you're all wrapped up in layers of clothing, but do try.

If you know what you feel like you'll be in with a chance of repeating everything, so make your brain work for you by checking that everything feels as it should do.

When you're shooting well and everything feels right, send your brain off on a journey round your body and try to get a blueprint of what every part of you feels like.

Newer shooters will find their brain having to cope with a lot of messages about pain and aching muscles, sore elbows, eye strain, etc., but don't worry, that's perfectly normal - it *will* get easier!

The next step, after learning to concentrate and make use of your brain, is to develop the right mental attitude.

The world is made up of optimists and pessimists - you know, one says a glass is half full, the other says it's half empty. That could also be down to either a positive or negative mental attitude.

Most coaches will be trying to instil a positive mental attitude in their protégés and you could learn to do the same thing, but be careful: over-positive mental attitude could also lead to over-confidence, and we all know how good the sport of shooting is at bringing you down to earth.

Confidence brought on by the right mental approach is good, but it's a question of exactly how far you should go with this approach.

You could enter the British Championship thinking you're going to win and if you're a top class shooter then this is not unreasonable. However, if you normally shoot in one of the lower classes, you would probably know in your heart that you have very little chance of winning. So how far down the list do you aim? (pun intended!)

If you're entering the championship for the first time, you don't have a yardstick to measure your performance by; you may *think* you know how you should perform, but in practice that doesn't always work out.

You could adopt the attitude that, as it's your first time it doesn't really matter where you come. Some people would say that was too negative, but it's not really as straightforward as that. You could, for example, say that it doesn't matter where you come this year because you're going to improve on that next year.

If you've taken part before, then you could say that you're going to better your last

position. (Notice that doesn't say 'better your score', because there might be some outside influence, such as the weather, which reduces everybody's score).

The mental attitude which says you can beat your past performance is positive, without reaching for an impossible goal.

Alternatively, you could select somebody whom you consider to be a better shot and single *them* out as the person to beat, wherever they come in the competition. This also develops a positive mental attitude.

Your own personal view should be that, regardless of what the competition is, you're going to shoot to the best of your ability. This sounds a bit obvious, but it's amazing how much mental effort is required to get the best out of yourself when you need it.

It is a well-known phenomenon amongst sportsmen that if you enter a competition thinking that you're going to lose, perhaps because you're overwhelmed by the competition, then you *will* lose.

In shooting there is an obtuse rule which applies: because we don't need adrenalin to get us pumped up, entering a competition knowing that you aren't going to win can sometimes bring about a relaxed state that has been known to lead to some surprisingly successful results.

The problem is: how do you reach just the right mental state which allows you to be positive yet relaxed, and confident without being over-confident?

The answer is mind control. You *have* to be in control of your brain, even though you may have to play some little game with it and fool it into thinking the way you want it to - it's up to you to devise your own personal approach and practise and develop it to your own benefit.

To give you some idea of what this is about, there are some top international shooters who have shot brilliantly when they've been angry, either with themselves or about something which has happened before the shoot.

Now obviously you don't go around raising your blood pressure by getting annoyed at every little thing which upsets you, as that could be very destructive, but there is a chance that getting slightly aggressive could stimulate the attitude of "despite what's just happened, I'm still going to win!"

Supposing you had a puncture on the way to a major shoot - would that destroy your positive mental attitude, or would it stimulate an aggressive frame of mind, or would you have the "oh well, I didn't want to win anyway" approach?

Some people who've had traumatic journeys to the range, arriving hot and flustered, have then gone on to shoot very well, so obviously something happened - perhaps their journey took their mind off worrying about the shoot (this is where it depends on which portion of your brain is doing what).

Those people who can weather any storm with a calm and placid approach, may shoot well after or during a crisis, but may not be able to get the adrenalin flowing enough to shoot well when it's needed.

Whilst we don't need to get excited during a shoot, a certain level of adrenalin can sharpen up your senses and reactions, which you do need. So if something goes wrong on your way to a shoot, don't get aggressive enough to get angry, just get positive.

Whatever you do, don't go onto a firing point with an empty mind - most people have difficulty completely emptying their mind anyway (try it now), but you could wander onto the firing point not really thinking about what you're doing; your mind will then flit about, thinking about anything that crosses its path, so get a hold of it and make it think about what you're about to do.

Champion athletes plan their races before they start; they know what they're going to do before the starter's gun goes off, and there's no reason for you not to do the same - if you think shooting your match in your head is boring, it's because you're not concentrating.

Before you go onto the firing point, and after you've assembled and checked all your kit, just spend a few minutes thinking about how you're going to shoot the match; treat every card as a match, even if it's just a warm-up or practice card.

If you do this, there won't be room in your head for irrelevant thoughts (if you can win the match in your head, it might just come true when you're shooting).

Preparation time before a match is important, principally so that you can get all your equipment ready, but while you're doing that, get your brain ready at the same time; lead it gently into shooting mode by starting with the check list of your kit - you may still be using your piece of paper, or you may now be able to do it in your head.

When you have everything ready (including your targets), spend the next few minutes thinking about what you're going to be doing for the next twenty. If you're shooting outdoors, check the weather (wind, sun, etc.) and consider how you're going to tackle the various conditions (aiming off, waiting for the wind, etc.), then visualise yourself laying out your kit in the right place, settling down and shooting.

This takes a bit of practice, but with thought and care you'll soon get the idea.

The biggest problem you'll have will be to convince your friends that you haven't just become a miserable old so-and-so who won't have anything to do with his mates. Just show them this chapter and by the time they've read it they're sure to understand!

There's plenty of time for laughter and jollity after you've shot, and with good mind control you can leave your thinking until just before you shoot - there's no need to meditate for hours beforehand.

If you're shooting outdoors it's very important to study the prevailing conditions before you shoot - this is all part of your pre-match thinking.

If the wind, for example, is blowing from left to right, is that the same as it was the last time you shot? If it is, then your sights should require very little adjustment; if it isn't, what are you going to do about it?

With a bit of thought beforehand, you could be prepared for what you're going to do, or you could even make some adjustments to your sights to ensure you're somewhere near the centre before you start.

Finding that your first few shots are centre 'bulls' is a great confidence booster, and that gives you time to measure the wind deviation etc. without wasting time zeroing in.

Once again, don't go too far in one direction in the mind control area; if you concentrate 100% on your pre-match preparation, you might miss the start of the detail, or some valuable information being announced over the tannoy.

This is where being in charge of your brain is important; you have to be able to switch in and out of a mode at will. The lowliest, most sluggish computer has an advantage over us in that you can just press a switch to change what it's thinking about, whereas your mind might take a little more convincing.

Anybody who admits to being able to shoot brilliantly on a practice card and hopelessly on a match card suffers from lack of mind control.

Everybody says "what's the difference between them?", but when it comes to the crunch, it's amazing how many people perform apparently better when there's no pressure on them. 'Apparently' because it's all in the mind again - the only part of you or your equipment that knows that the card has a sticker on it, is your brain.

If your club Captain went along secretly putting stickers on your practice cards

without you knowing, you'd shoot all your cards with gay abandon, and shoot them all equally as well. Unfortunately life isn't like that and this card you're about to shoot is very important to you because it's the first time you've been asked to shoot in a club team, and you want to do well.

So what happens? Your brain puts the mockers on it for you! It starts worrying about you not shooting well and letting everybody down, and you just *know* you're going to be the lowest scorer.

So who *is* in charge, you or your brain? You'll get all sorts of help from fellow club members about calming down and not worrying, and if they're smart they might even remind you that you're helping the team just by shooting, because if you don't shoot then they'll lose even more points than the lowest score *you're* likely to get.

Of course your brain, in its panic, won't accept that and you now wish that they'd asked somebody else. This is where positive mental attitude comes in - think of all the positive things that you can: for example, the Captain asked *you* because you've shot well in the past, or at least you're up to the standard that he expects, therefore you can do it again, can't you?

It's your overall average and standard that the Captain is looking for; if you average 95, but last week shot a 100, then he's going to be asking you to shoot on the basis of your 95 not the 100, so all you have to do is shoot to your average.

Very often, a good team member is not the best shot, but the one who is there when he's needed and turns up when expected. So by just being there, ready to shoot, you've already proved yourself to be a good team member.

Think of the camaraderie; your fellow team members all want you to shoot well, they're all on your side. The more experienced ones will be only too delighted to offer you help and encouragement - they won't be thinking about you letting them down, they're only too grateful that you're shooting at all.

Nobody will expect you to be the top scorer, so there will be more pressure on those team members who usually put in a top score, so relax and enjoy the experience. With your brain full of positive thoughts (those mentioned above aren't the only ones), you won't have room for negative ones.

None of this will happen on its own of course; left to its own devices your brain will disappear off down the nearest rabbit hole to its own little dream world, so *you* have to get it back on line and make it think about what *you* want.

One last thought about the vagaries of the mind: isn't it amazing that when you're laying in bed after a traumatic, awful day, you can't get to sleep because your brain

won't stop worrying, but after a wonderful day when you had the best shoot of your life, you fall asleep almost immediately.

CHAPTER 20

FAULT ANALYSIS

Coming off the firing point after a particularly disastrous shoot someone was heard to remark that his shooting was a 'Comedy of Errors'. That may be an amusing turn of phrase but there's many a true word spoken in jest, and most of our shooting consists of one error or another

If you're going to try to analyse your errors then *don't* - at least not without a great deal of careful thought.

It's fairly obvious that you can't get very far in your shooting career without some attempt to correct whatever it is that stops you getting a perfect score. However, fault analysis can be a trap for the unwary, not to mention an area full of myths and legends perpetrated by the more experienced shots.

The only person really capable of accurate fault analysis is you, and 90% of the time even *you* don't know what happened; the problem is that you think you do.

You might think, for example, that the shot went up into the '8' ring at 2 o'clock because of some dimly-remembered advice given when you were a beginner, stating that tensing your left arm would cause the shot to go up there.

That advice was probably passed on by one of your more experienced club members who was trying to be of assistance when you went to him for help. It's not that he was wrong, more that - like everything related to target shooting - it's not the whole story.

If you wish to hear the whole story, read on - these are some of the things that could happen when you make a mistake.

First of all: even that dead-centre perfect carton bull wasn't necessarily error-free. That's obviously where you'd like your shots to go and if you could re-create the same 'errors' every time they probably would.

Similarly, if you only made one error at a time life would be much simpler, but the human body isn't always the finely-tuned piece of machinery you'd like it to be. Usually it's a wobbling mass of living tissue, incapable of exact repetition even after many years of training.

Your body is designed to survive in its environment - it's not a precision instrument, so expecting it to act like one without a great deal of effort is asking a bit too much.

Most of you will probably know what it's like trying to throw a rolled-up piece of paper into a waste paper basket across the room - some days you make it and some days you don't. Shooting's a bit like that; it would be impossible to ensure that your body functions in exactly the same way every day and for every throw of the paper ball.

However, before you all pack up shooting, there is an 'up' side to all this, which is that the champions are the ones who've worked out what they need to do to minimise their body's ineffectiveness and inconsistencies - half the battle is knowing what you're up against. So now let's return to that 'Comedy of Errors' to try and quantify what the errors are.

Firstly, no rifle is perfect. That's an obvious statement, but how many of you keep repeating the phrase "the rifle shoots all right, it's just me"? How do you know that it *is* just you? You probably think that because you occasionally do manage to get five shots together, it's your fault when you don't, but it isn't that simple.

Every new rifle comes with a 50-metre test group, shot in the maker's factory in perfect conditions with the barrel and action clamped in a vice. Even under those conditions no rifle will put 10 shots through the same bullet-sized hole at 50 metres.

(Rumour has it that the test group doesn't belong to your particular rifle at all, but even if that *is* the case it's not so important - all the factory is doing is showing that the rifle reaches a certain standard.)

The rifle itself will be responsible for a certain size of group even if the ammunition is absolutely perfect (which is very rarely the case); that group may be very small, but it will still be a group.

It is, of course, possible that some rifles shoot better than others, but these days a modern factory can turn out such good consistent products that the differences between a standard rifle and a brilliant one are slight.

At Olympic standard those differences could affect the medal placings, whereas at club level the shooter has more potential for error than the rifle.

You should also remember that your barrel starts to wear out from the very first shot fired down it. You can't subject a piece of steel to the heat and pressure of an exploding .22 round without something eventually starting to wear out.

During the first years the wear is very gradual, but eventually as the steel starts to crack and break up and bits of it disappear down the barrel, so it starts to affect the way your rifle shoots. Therefore the first error created could come from your rifle and unless it's in its first flush of youth, it is *very much* on the list of suspects.

Next comes the ammunition.

You get what you pay for when it comes to ammunition and what you pay for is good quality control coupled with better and newer machines to make it on.

We've all heard stories about somebody who once had a batch of *Eley Club* which was brilliant and outshot any *Tenex* around at the time, or about a batch of top grade ammunition which was rubbish and had to be sent back because it wouldn't shoot.

No commercial manufacturer can guarantee to make perfect .22 ammunition - it's impossible, and it would be very time consuming and too laborious to make your own (although it can be done), particularly in the sort of quantities a target shooter uses. Therefore, you're going to have to accept that ammunition isn't perfect and that it varies from batch to batch. It's up to you to find the best combination.

Now you have two parts in your error formula.

The next is the weather. Obviously shooting indoors doesn't usually mean a wind-rain-sun-mist-mirage problem, but there are other problems such as inadequate lighting and having to move so much between aiming marks.

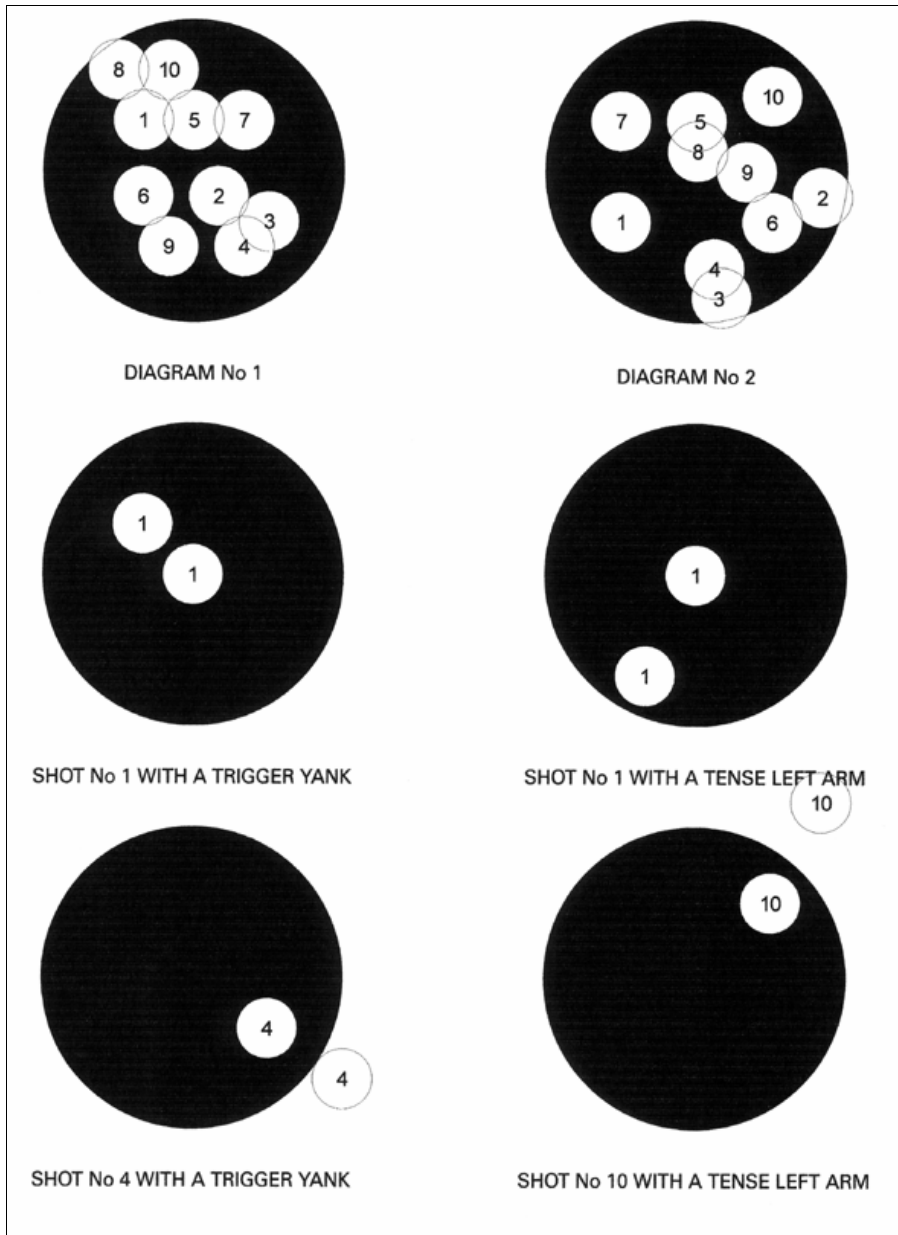
However, the most dramatic effect on your perfect shot is caused by the wind (well 4 inches at 100 yards from a 10 m.p.h. crosswind is pretty dramatic, isn't it?)

So, there's three things which affect your group size; now comes the biggest - **you!** You have a very dramatic effect on the size of your group, because even the fittest athlete in the world is still a quivering mass of nerves and sinews.

When you release the trigger and start the ignition process in your cartridge, the way you do this has an influence on where the bullet goes. Remember that shotfall in a group from just the rifle and ammunition is purely random, and you have no way of knowing where the first or last shot is going to go. That's why you need more than a couple of shots to define your group.

As you take the various elements that influence the group and start to add them in, so the group gets larger; however, it can be possible for some of these elements to have a cancelling-out effect.

Consider diagrams 1 and 2; they show purely random shotfall from a rifle and ammunition. The group and shotfall has been enlarged and spread out to make it clearer, but you can liken it to the size of group you may get at 100 yards.



Errors can add or subtract from our group size

Because it is purely random, the bullet travelling down your barrel could be going anywhere in your group. Now, supposing that at the time of releasing the trigger there was a right-to-left crosswind which speeded up slightly just as you released the trigger, but at the same time you made an error (perhaps twitching the right shoulder) just as you let the shot go.

If you noticed the wind change, if you noticed the slight shoulder twitch, if you knew which shot in the group you had just fired then maybe (just maybe) you could give some sort of reasonable estimate as to where you think the shot may end up.

If that sequence of events coincided with shot No.1 in diagram No.1, it's possible that the shot could have gone where shown in diagram No.3. However, if the bullet going down the barrel had been No.3, then the shot could have ended up as shown in diagram No.4.

So with a modicum of thought it's probably occurred to you that the shotfall is subject to a series of pluses and minuses. Let's say, for example, that you wish to shoot a carton bull and let's say that every error which helps you in that direction is a 'plus', and every error which doesn't is a 'minus'.

Assuming you've zeroed in correctly, every error is going to take you away from the bull, but what if some of the errors cancel each other out?

For example: you've just fired shot No.8 in the group from diagram No.1. As you can see, left to its own devices that bullet would go to the top left-hand corner of the group. But suppose that, at the same time, you were a bit careless with your trigger technique and had poor follow-through, or had snatched the trigger; that *could* have dragged the rifle down to the right.

This would have counteracted the group shot and it may, if the influences were equal, result in a perfect carton bull. You would then congratulate yourself on being a brilliant shot and try to repeat the exercise.

You might remember vaguely that there was something different about the trigger release and try to re-create it, only this time it coincides with shot No.9 from the same group and low and behold - you have a '9' because this time all the errors worked against you. Now, are you confident you know how to analyse your groups?!

To make matters worse, there are lots of things which you can do to your rifle while the bullet is travelling down the barrel which will influence where it goes, so here's a list. This is by no means complete, but by just looking at it you'll soon appreciate that you could combine any of these together without realising it.

Basically, any part of you which touches the rifle will have an influence on it, so we have a wide variety to choose from.

Assuming you shoot right-handed:

Left hand

1. Tensing the left arm
2. Clenching the left hand

3. Touching the stock with the fingers
4. Heavy pulse beat because of wrong sling adjustment
5. Sideways pressure because elbow is in the wrong place
6. Sling in different place.

Right hand

1. Grasping the pistol grip
2. Right elbow in the wrong place
3. Gripping the stock with fingers
4. Sideways pressure from thumb
5. Hand bent into 'S' shape, resulting in twitchy trigger finger

Head

1. Varying cheek pressure
2. Cheekpiece too low - head lowering during shot release
3. Cheekpiece too high - too much pressure on stock
4. Locating cheek in different place after reloading

Shoulder

1. Butt too high - pushing forward to get head down
2. Butt too low - craning neck to see through sights
3. Butt too long - varying pressure on butt when loading
4. Butt too short - pulling shoulder away from butt

Eye

(Whilst, strictly speaking, the eye is not in contact with the rifle, it's nevertheless important that it's in the right place and is relevant to the cheekpiece)

1. Too much, or too little eye relief
2. Eye not central in aperture
3. Eye not focussed on foresight

The other parts of your body which aren't in contact with the rifle still have an influence; your breathing, for example, could affect where the shot goes.

If you take all the areas where errors could occur and mix them all together you get an enormous potential for mistakes, but sometimes all these things work against you and sometimes they cancel each other out.

A shoulder twitch could cancel out a trigger pull; the trouble is that your brain may only register one error, so how can you analyse what caused the shot to go where it did, when you may have made three or four mistakes, each one to a lesser or greater degree?

Now let's hear your explanation of why that shot went into the '9' ring at 8 o'clock!

By now you're probably wondering how on earth anybody manages to get a bull with all those possible errors you can make.

A champion will still make lots of mistakes but his group will be so small that those errors will still result in bulls (i.e. if you could shoot a group a quarter of the size of the bull, and you were sure you were zeroed in on the middle, if you made a mistake which doubled the size of your group, the shot would still be in the bull).

So how do you get your group size down to a quarter of the bull? Well, the first thing you have to do is to appreciate that *this* is what you're trying to do.

You might say "it's obvious that's what I'm trying to do", but if you were totally honest with yourself, how often do you go up the range with a target with the scoring rings blocked out and spend the day trying to get the smallest group you can?

How many clubs have a competition for the smallest group shot at 100 yards regardless of where it is on a target? The problem is that everyone's become score-orientated and the quest for the magic 'ton' becomes paramount; then there are league cards to be shot, projects to be done on the range, families to look after, jobs to go to, etc, etc.

Of course, if you were to practise as well as shoot league cards, you may well need to double your time on the range and that could be difficult for some people. However, if you want to improve your shooting, practice has to be done, although *not* on league cards or at open shoots.

(Certainly not on league cards because you're probably in a team and you'd be letting everyone down if you didn't try to get your best score; and who would admit at an open shoot that they threw away points because they were practising? Nobody wants to look incapable in front of others.)

So, going back to all the errors that you keep making, how do you set about reducing them?

The Rifle

Firstly, it's important that your rifle is performing at its peak, so regular checks on its condition should spot a cracked stock, bulged barrel, loose sights, loose butt plate, sling swivel handstop and all the other million-and-one things that could go wrong.

As mentioned earlier, your rifle is always in the process of wearing out and that's obviously a deterioration which you can't do much about, because the only way to halt it would be to stop shooting it and that's rather self-defeating.

Don't think that, by not practising, and shooting as little as possible, you're prolonging the life of your rifle; you may be, but your shooting will get worse a lot quicker that way.

No manufacturer is going to say how long a rifle will last because it depends so much on its use, cleaning, ammunition, etc, and it would be extremely stupid to say that any rifle over a certain age is not shooting its best.

So regular checks are essential; it may be boring, but getting into the habit so that it becomes routine, helps enormously.

The decline in the first part of a rifle's life is very slow, so if you've bought a new gun in the last few years you should have nothing to worry about. If, however, you calculate that your rifle has shot 100,000 rounds or more, it will definitely be suspect.

The deterioration will have started before that figure, so that number is not engraved in stone, but if you regularly shoot 100 rounds a week you'd reach 100,000 in 20 years. That seems a long time, but now look for the date stamped on the barrel of your *Anschutz*:

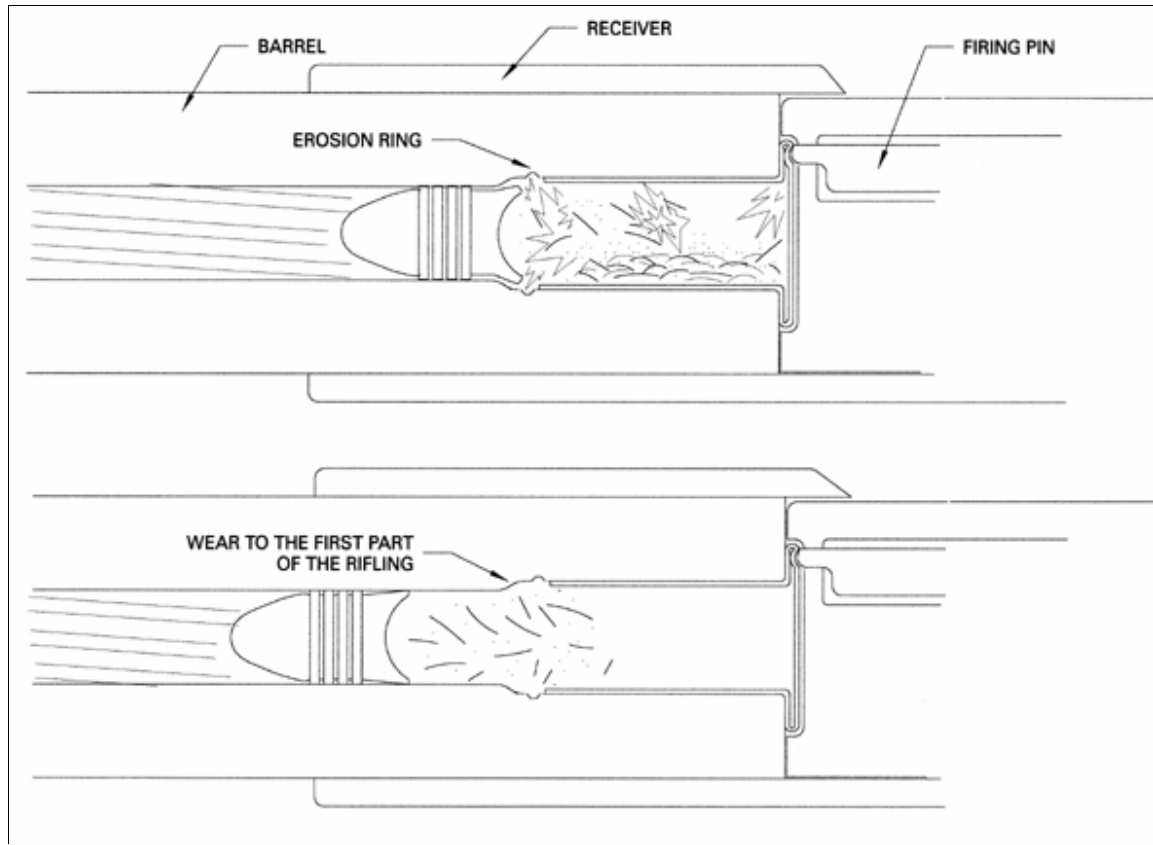
If it actually *has* a date then it's more than 20 years old (they stopped putting dates on in 1976), and 100 rounds a week isn't very many.

You may, of course, have a rifle which really hasn't been used very much, in which case, don't panic. In fact, don't panic at all - there's still the possibility that you're shooting worse than your rifle, however old it is!

Nevertheless you're still coping with a variable that a top shooter doesn't have because he replaces his rifle (or, at least, his barrel) at regular intervals. You may balk at the cost of replacing your rifle, even if you go for one that's slightly newer than yours rather than a new one, but balance that with the cost of, say, fitting a new barrel into your old stock or action.

If you go the route of replacing your barrel, then be extremely wary; question everybody you can find with a replacement barrel. Ask where it was done, who by, and whether they've seen a notable improvement in their scores since the work. Replacing barrels is a very skilled job and needs to be done by a well-qualified gunsmith.

The problem with old barrels is that they lead up and that means they are stripping lead from the bullets. Obviously there's a limit as to how much lead comes off each time: if it was a continuous process then eventually your barrel would close up, but unfortunately every so often the lead gets blasted out and the process starts again.



Despite what people might tell you .22 barrels do wear out

This means that there's a variation in the velocity of the bullets exiting the muzzle, which could result in a height variation on the target. It could mean an extremely wild shot followed by a couple of others (also not in the middle) then the group returns to the middle and things settle down until the lead builds up again, and gets blasted off once more

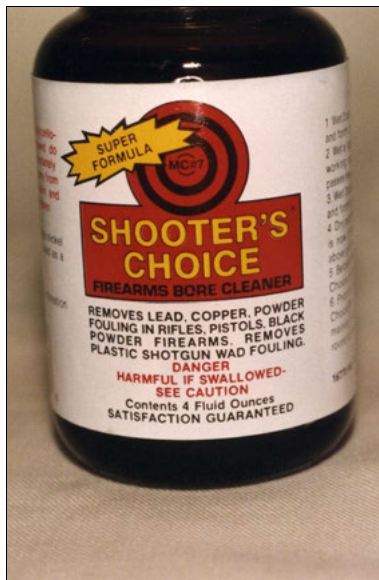
It would be nice to say that the effect is a purely up-and-down error and, in older books on shooting, it's been suggested that the bullets gradually climb up the target and then suddenly fall back into the bull. The theory is that each bullet gets successively slower owing to the restriction in the barrel, until the lead's blasted out, when they all start going faster again and consequently arrive lower on the target.

Things are never that simple; what is more likely is that things go on as normal until suddenly one bullet picks up a great lump of lead (because it's grown too big for the bullet to get past) and comes out of the muzzle with a carbuncle of lead stuck to it.

Where that bullet goes depends on where the extra weight is added, but one thing is for sure, it *won't* go into the centre of the group!

So, while you're shooting, if you suddenly get an unexplained shot followed by a couple of others which gradually get closer to the group, and your barrel is getting on a bit, this may be your problem. However, before you dash down to your local gunshop with the housekeeping money, hold on - there are a couple of things you can do to confirm, or even help, the situation.

Firstly give your barrel a thorough scrub with a phosphor bronze brush and a lead-dissolving oil such as *Hoppe's No.9*, *Parker-Hale 009*, *Shooter's Choice*, etc. (If you're not sure, read the label and if it says it removes metallic fouling, then that's the stuff.)



**It says it removes lead
and that's exactly what it does,
without harming your barrel**

Neither the oil nor the brush will do any harm to your barrel; the oil only attacks non-ferrous metals and your barrel is made of steel, which is ferrous.

'Scrub' really means scrub, but not backwards and forwards (your brush won't last very long like that); take it right out of the muzzle and then pull it back again, but do it lots of times - at least 10 (if not 20). After that, thoroughly soak up all the residue with patches or cleaning felts, and get onto the range and shoot it.

It may take some time to settle down and the longer that is, the worse your barrel is likely to be. If it isn't shooting to the centre of its group within five shots, you could have a problem.

Now what you have to do is decide whether your barrel shoots better clean or dirty; obviously you can't clean it after every *shot*, but you may have more confidence if

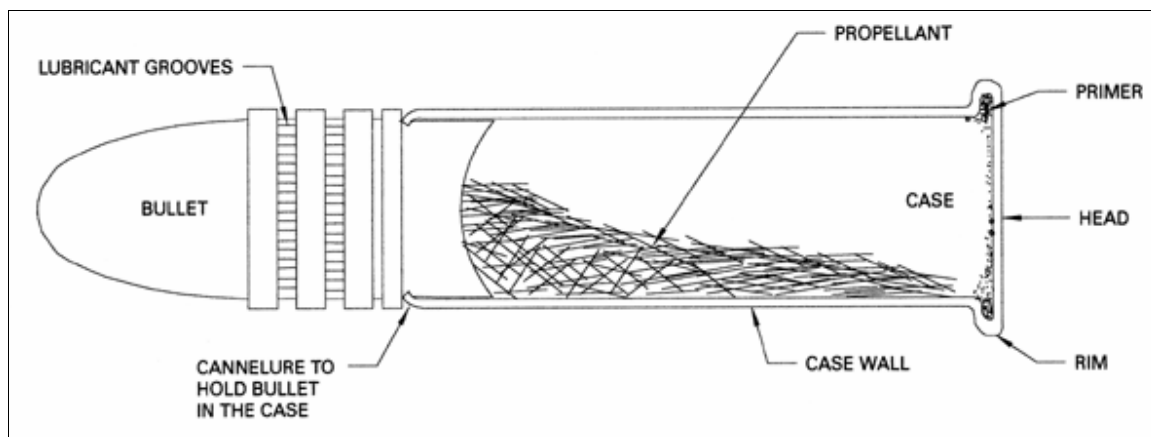
you clean it after every *shoot*. (Again, 'clean' means the above phosphor bronze brush treatment, not just a quick patch down it to remove the residue.)

By following the above procedure you will at least have some control over the situation until you can invest in a new barrel; by carefully monitoring how it shoots you can get the best out of it when you need it.

It's important to emphasize here that it's the *size* of the group which is important; that's the *only* measure of your barrel's performance.

The Ammunition

The next variable over which you apparently don't have a lot of control is the ammunition.



The .22 round of ammunition and what's inside

You may consider that you have to take what the manufacturer hands you and nothing can be done to improve upon that, but you'd be wrong. There's a lot you can do.

There is no suggestion that you should in any way tamper with an individual round. *Don't*, under any circumstances, be tempted to wipe off the lubricant; it's there for a good reason, which is to reduce the leading in your barrel, so bearing in mind the above, the lubricant is the last thing you should be interfering with.

The first and obvious thing to do is buy the best you can afford.

Every old club marksman could entertain you with stories of how he once had a brilliant batch of '*Brand X*' which nearly got him to the Olympics, and how much better it was than the expensive ammunition, or the modern stuff you get nowadays.

These are very entertaining *stories*.....

Ammunition manufacturers have one object in life and that's to sell ammunition, make a profit and stay in business.

So what *is* the biggest selling point in the ammunition world? The fact that a shooter wins medals with it, which proves it's good ammo, so everybody wants to use it. Therefore, it's in the manufacturer's interests to produce the best he can, but the best is usually expensive.

Logic dictates that no manufacturer will produce rubbish ammunition and get top price for it, so put your faith in the manufacturer.

But (yes, there's always a 'but') making ammunition - even with today's technology- is still a bit of a black art. It requires a certain mixing of the right ingredients, whose own inconsistencies produce variations in the final product - the bit you buy.

Because of this you'll need to select the best ammunition for your rifle and the way to do this is to constantly check the size of your groups; don't leave anything to chance.

Keep a note of every batch number that you use (it's on the box somewhere). Two boxes of the same brand of ammunition with different numbers could shoot differently through your barrel; that's because they may have different velocities (there may be other differences, but velocity is probably the one which affects performance the most).

Rumour has it that top shooters get special ammunition (and certainly it's in the manufacturers' interests to make sure that a potential world champion is going to use the best) but there's still no guarantee that it would suit *your* rifle.

Top shooters have also been known to 'grade' a particular batch of ammunition by measuring the rim thickness, and even weighing each round. You'd have to be shooting really well to notice the difference, but championships can be won or lost on a point and that could be as little as one thousandth of an inch at 50 metres, so don't dismiss anything which may gain you even one point.

At club level it's important to use the best you can, but you can also do a little more to help yourself by adjusting the torque setting of your bedding bolts and seeing what dramatic effect it has on your group size.

If you have a batch of ammunition that you're not happy with, please don't go back to the manufacturer complaining that it's rubbish (unless there is something obviously wrong with it, such as the shape, caused by a machine malfunction). You may be rejecting ammunition that another club member thinks is the greatest stuff since sliced bread.

Any half-decent gunshop which sells target shooting equipment will be able to offer you or your club a selection of at least two different brands of top-grade ammunition.

Be prepared to experiment and don't rely on other people's experiences; the fact that one person had a bad shoot with '*Brand X*' doesn't mean that *you* will. Even if several people reckon that a particular batch isn't right, it doesn't mean that it won't suit you, so try it for yourself.

All ammunition is made in batches and in the case of *Eley's Tenex* that's only about 25,000 at a time, i.e. only five boxes of 5,000 for the whole of the country.

Another habit to avoid, is using one grade of ammunition for practice and another for competitions. There's no problem with you practising a technique which doesn't involve any interest in where the bullet goes (is there such a technique?), but if you use different ammunition in different circumstances how on earth are you going to know whether the shot in the '9' ring was you or the ammunition?

You should be so used to how your rifle-and-ammunition combination works that you *know* that the shot in the '9' ring was *your* mistake because you read the wind wrong, or whatever, instead of wondering whether it was the ammunition.

It is expensive to use top grade ammunition when you're practising, but part of what you're practising is how to win a competition, and if you then use something different you defeat the object of practising.

Other equipment

It's easy to label everything which doesn't result in a good shot as a mistake, but you aren't really making mistakes you're just being human and that means being inconsistent, because you're not a machine and therefore you're not capable of exact repetition for any length of time.

Any musician will tell you that he never ever plays a piece of music exactly the same way each time he performs; it will be the same tune and in the same time, but there will be slight variations which maybe only he notices.

So how does a top shooter get to be so good? He reduces his inconsistency to a minimum and strives to repeat each shot exactly, but how are *you* going to do that? Obviously you need to learn what causes these inconsistencies in the first place.

You may have done away with all the tenseness in your arm, but was your sling in the right place to start with? The sling around your upper arm shouldn't be too tight, in fact you should be able to get at least three fingers down inside the front of it so that it pulls from the back of the arm, but doesn't crush or squeeze the main artery running down inside.

If your sling is loose enough to do this, it will move around on your arm, so you must be ultra careful to ensure that the last thing you do before lifting the rifle into your shoulder is position the sling correctly, before it has to support any weight.

It will be impossible to move it properly once the rifle is in your shoulder, so look down at your sling as you're ready to lift the rifle butt, make sure that it pulls from the middle of your arm, and make sure that it's always in the same place.

While on the subject of the sling, it should follow the same path under your hand every time, and take care that there are no bundles of jacket sleeve caught up in it which could affect the tension.

Those of you with telescopic sights know all about pulse beat and how dramatic it looks, but it's there for everyone and the problem is that you tend not to notice until you suddenly realise something's wrong half way through a card, so get it right before you start!

Still on the subject of that arm, it's very important to get your elbow in the same place every time; you say you always do, but how do you know?

Bundled up in a thick jacket with a sling and a glove, you can't exactly measure your elbow position to the nearest quarter of an inch, yet even that small amount will vary the tension in the supporting triangle of your arm and sling, and your rifle will notice.

You can, of course, argue that it doesn't particularly matter as long as it's in the same place all the way through the shoot, and you'd be right - up to a point. However, an elbow in the wrong place can lead to more sideways pressure on the rifle which will open the group up.

You'll probably then try to compensate and on the next card you may think you've got it cracked, but the elbow goes somewhere else and your compensation is, this time, causing its own errors.

Of course, because you don't roll over to reload (you don't, do you?), there's no chance that you're going to be moving that elbow while you're shooting, is there?

Your elbow should go anywhere between the sling and rifle. However it shouldn't be outside the sling because that puts too much side pressure on the rifle, nor should it be too far under the rifle, because that makes it unbalanced and puts too much sideways pressure on you, leading to possible interference with the rifle.

So where exactly is the right position for you? It will vary, of course, depending on your size, but generally the right place is just inside the sling at a point where you're balanced.

Being in balance is extremely important; you know you aren't going to fall over, but when everything is balanced it means you can relax and nothing will move, because you're in a state of equilibrium. Therefore you need to learn what your elbow feels like when it's positioned correctly so that you can repeat it from memory.

The prone position is all about triangles and how they inter-relate. There's a triangle formed by your other arm and the rifle, there's a triangle formed in plan view between the rifle and your supporting arm and there's almost a triangle formed by your body and legs.



**Get the triangles right
and your groups will improve**

All these must be balanced without one having any undue influence on the rifle, so that when it recoils it does so straight backwards without wanting to leap off to one side.

Crossing over to the other side of the rifle you come to one major source of shooters' errors - the trigger hand.

You should keep a relaxed grip with your trigger hand - it's not there to hold the rifle in position (that's done by your shoulder and the other hand), it's there to enable your finger to reach the trigger, so keep it as straight as possible.

If you're lucky enough to have a thumbhole stock, put your thumb through it- that's what it's there for. It doesn't have to go all the way through, in fact if the pad of your thumb was to stop in line with the trigger you could ensure that squeezing between finger and thumb would result in a straight backwards trigger pull, couldn't you?

Grasping the pistol grip tightly gives something else for the rifle to react against when it recoils. You could argue that this doesn't particularly matter if it's the same every time, but it's easier to be consistent with a very light hold than a heavy one.



Cheek pressure is important

During the excitement of a match you could get tense and vary your grip on the rifle, but it's more difficult to get tense with a relaxed loose hand and, therefore, it's much safer.

The next item on the list of things to analyse is the elbow of the trigger hand. There should be no weight on that elbow at all, otherwise that's something else which could influence how your rifle recoils.

After carefully placing your hand in exactly the right position, the elbow is gently lowered to the mat as the last operation, then you're ready to concentrate on the shot.

If your sights aren't aligned exactly or your bubble isn't central, you can raise it and lower it again until you get it right. If your position is correct, raising and lowering that elbow won't affect your balance.

Gripping the stock with the fingers and thumb (which wasn't on the list) has already been dealt with.

Next we move on to the head, which can be quite a heavy item, and when lent on the cheekpiece of a rifle it can have a dramatic affect on its recoil. It could be responsible for a vertical shift in the group by effectively adding weight to the back end, thereby reducing its upward movement, or increasing it, as the case may be.

How you get it right is all down to feel - consistent pressure is the answer. That sounds obvious and, if you have a method of ensuring that your cheek pressure is always constant, do continue with it. If not, read on.

Cheek pressure is all about the relationship between the sight line and your eye, and the position of the butt in your shoulder; getting all that right gives you a consistent cheek pressure. Therefore you need to do a lot of experimenting in position, totally relaxed, with your eyes closed, so when you open your eyes you're exactly in the centre of the rearsight, not just once but every single time.

If your cheekpiece is even only slightly wrongly adjusted, your cheek pressure could increase if it's too high, or your head could sink down during shot release if it's too low.

If you didn't have to take your cheek off the rifle when you reload, life would be a lot easier. For example, one of the reasons why so many people shoot better with a telescopic sight is that they don't have to move their head to look through a spotting scope to see where the shot has gone.

As most of us have a cheekbone somewhere under our eye, it helps if the rifle has an edge which is just the right shape to fit under the cheekbone. It's also a great advantage if you cant your rifle, because that takes it away from the jawbone which has some very strong muscles attached, which are prone to tenseness (hence clenched teeth).

The old *BSA* stocks had a great expanse of wood as a pad to lay your cheek against, without anything to use as a location aid and you'll often see that these have been adapted to provide some sort of reference point.

Canting the rifle towards you will stop you pushing your head over in order to see through the sights. Don't be tempted to carve out an enormous amount of wood just so that you can keep your head upright and get your eye behind the sights - this is a waste of time. However much wood you take out, it will never be enough, because

your eye isn't in line with your shoulder (just look in the mirror if you aren't sure about that).

It's much better therefore to lay with your head level, so as not to disturb your balance or your vision, and bring the rifle over to you. By making everything as natural as you can, you'll be reducing the areas of conflict or tension which your rifle will react against when it recoils.

The shoulder

The next major area of error is the shoulder - that great bulge of muscle and sinew at the top of your arm, joined to the neck and containing one of the few bones in your body which can get in the way of your shooting, namely the collar-bone.

Many's the time you'll hear people complain of a wrongly-shaped butt plate contacting and pivoting on their collar-bone. In a perfect world you'd just push your shoulder into your butt plate and it would mould itself to your shape, but unfortunately that's not easy to organise.

At least 25% of shooters are shooting with a wrongly-shaped or wrongly-adjusted butt plate, so give some careful thought to yours.

CHAPTER 21

PLATEAU OF MEDIOCRITY

The 'Plateau of Mediocrity' is something we've all experienced at some time or other.

You may not have realised that you were suffering from it at the time, but it can be a very frustrating experience, particularly for those people who want to shoot better. But if you're content with your shooting and have no desire to improve, you could be destined to spend the rest of your shooting career stuck on the 'Plateau'.

Before the rescue attempt, a short explanation is in order so that you can recognise whether or not you have a problem, but don't worry, if this describes your situation - you're not alone. In fact, anybody whose shooting is not currently improving could be deemed to be suffering from this malady.

When you start shooting, then there's only one way to go - up. The more you shoot, the better you get. Even with only the most rudimentary idea of what you're supposed to be doing you're likely to get a better score every time you shoot, up to a certain point.

Do you remember how difficult it was when you first started? But do you also remember how quickly you got the hang of it? I'm not suggesting that you went from an average of 70 to 95 in a couple of weeks, but everybody's learning curve does go upwards quite steeply at the beginning.

At first, most club instructors, coaches, or helpful members will start you off shooting groups, so your scores at the beginning aren't too important, but improvements *can* be seen even before you get your first scoring card. It gradually becomes easier to get all five shots together instead of them flying about all over the place, especially when it's drummed in to you that it's consistency you're after.

Every time you shoot you should learn something; the problems begin when you stop being receptive to the learning process.

When you start keeping a record of your scores (and the dates on which you shot them) you'll probably see a notable improvement as the weeks go by. Each higher score can be looked on as a personal goal reached, and it's so wonderfully easy to reach a personal best.

After a while it becomes harder to continue the upward climb; suddenly your shooting isn't quite improving at the rate it did and there's a certain slowing down in the frequency of personal bests. This is absolutely natural and something everyone encounters; there's nothing you can do about it - it's the very nature of the sport.

Instead of it becoming a race to improve your scores, it becomes a competition against your fellow shooters, and the actual score isn't quite so important.

It has been known for the British Short-Range Championship final to be won with a score of 97 - a fairly mediocre score for that level of shooting. So when you consider how many of *you* have shot a 97 or better, you can see that the score isn't always important.

You can all put up a good score at some time; what you can't always do is beat your fellow competitors all the way through the heats, quarter-finals and semi-finals, and then hold your nerve during the final (or even a shoot off), and produce a reasonable score.

Because this slowing down in your performance occurs naturally, you may not recognise that you're in trouble, and this is where the problem really arises.

So, as you progress, you go from improving the score on individual cards to trying to improve your average, because it's your average that really counts in the long run.

Anybody can shoot a 'ton'; it's doing it every time you shoot that's important, but however well you shoot, you're simply not going to continue this meteoric rise to the top.

Suddenly the dreaded 'plateau' syndrome will strike and you'll realise that your average is faltering. If you find that last year's average was half a point better than the previous year's but now it's slipped back again - congratulations, you're on the 'plateau'.

(It's called this awful name because it describes the flat part of your learning curve - the time when nothing seems to get any better.) Some 'plateaux' may even have a slight downward incline - that's also not unusual.

It may occur several times during your shooting career; what you have to do is recognise when you're on it, *then* you can do something about it.

So what are you going to do if you're stuck? If all this sounds horribly familiar, don't worry, here are some handy hints for escaping from the 'Plateau of Mediocrity'.

One: Ask your fairy godmother to wave her magic wand, sprinkle a little stardust around, say the right words and *Hey Presto!* - your shooting will improve.

That may sound somewhat frivolous, but you must retain a sense of humour and behind every apparently stupid remark you may find a grain of truth. You may not know any fairy godmothers personally, but you *can* improve your shooting by doing absolutely nothing.

Having realised that your performance may be in the doldrums, it's important not to panic; everybody's been there and most have managed to survive the experience.

What you should do is just relax, recognise that you're just going through a bad patch, and become comfortable with the idea that this year's not going to be your 'podium' year.

However, the danger in this approach is that it's very easy to drift into the attitude of "I never wanted to be Club Champion anyway!"

The mental approach you should be taking is that you recognise that your progress up the ladder of shooting fortune is slowing down, so you'll take the opportunity of consolidating your strengths and gaining more experience by just going out and enjoying your shooting at whatever level you find yourself.

Once enjoyment sets in and you relax and forget about the frantic race to the top, you might be surprised at how many good shoots come your way.

Two: Panic!

This is exactly the opposite of the previous tip, but it works for some people.

The first thing they do is run round in small circles with their head in their hands, telling everybody how well they used to shoot.

The problem a 'Plateau' causes for these people, and why it is so devastating, is that they have a natural desire to be the best and they want to be respected by their peers. This is such a normal reaction that you *could* be considered odd if you didn't feel it, and if you do experience it you'll probably make a better shot in the long term.

So if you feel as if you're going to panic, don't be afraid to - it can make you sit back and think about what you're doing; just make sure you turn your panic into something constructive.

Get all your shooting kit out and spread it over the lounge floor; go over every single item, checking anything which doesn't seem to be quite right and put it right. Give your rifle a thorough clean, have everything off it, and check that all the nuts and bolts are done up correctly.

This is called constructive panic - it's a wonderful exercise in confidence-building.

Three: Change something.

Sometimes a slight change in position can help; get someone to take some photos of you while you're shooting, and then examine them closely; it's amazing what strange positions some people get into without realising it.

However, be very careful about this tip. You will notice that 'change something' is singular not plural. Do *not* go all over your kit changing everything in sight. This is dangerous and foolhardy.

The formula is that you change one thing and then measure (over a reasonable period of time) whether there's any improvement in your scores/average. If there isn't, go back to where you were originally, unless you're absolutely sure that it helps you in some other way (e.g. comfort).

Those people who are constantly revising their position or their kit just make life harder for themselves. All it means is that they make a mistake every time they alter something and they end up changing it again some time later.

Four: Buy something new.

This sounds a bit like the previous tip, but it isn't intended to be. It's wonderful how a new rifle can concentrate the mind. Don't let anybody persuade you that you *don't* need a new rifle - the biggest old wives' tale in shooting is that 'it's the nut behind the butt'. This is continually offered as an excuse for a bad shoot or a fall-off in your average.

Your rifle started wearing out from the very first shot fired down it. There may be thousands of rounds to be fired before that wear starts to have an effect on accuracy, but there *will* be an effect sooner or later.

Of course, a rifle discarded by a top international shooter may be perfectly adequate for the average county team member, and the rifle discarded by the county shot may be ideal for someone shooting at club level, and so on.

If a new, or newer, rifle is beyond your pocket, then try a new jacket or an iris and colour filter set for your rearsight. It's surprising what a new piece of equipment can do for your morale; there may not be any quantifiable effect, but the psychological benefit can be just what you need, particularly if you can identify a problem which appears to be solved by the new piece of kit.

Five: Get your eyes checked.

Your eyesight can alter alarmingly at any time, particularly around middle age, so go to an optician who knows what you're talking about.

Six: Practise more.

Cut out some of those leagues and take time to practise. It's very easy to get so wrapped up in producing shot league cards for your club captain that you end up being part of a production line, instead of working at your technique or perfecting your aiming off and wind judgement skills.

Don't just go to the range when you have league cards to shoot; it's very easy to claim that you don't have time to practise, but champions *make* time, even those with a wife/kids/overtime/ailing mother, etc., so don't look for excuses, do it!

On the other hand, don't just go to the club and pour lead down the range - that isn't practice, it's a waste of money; set out a programme to cover the particular points you think you're weak on.

On your outdoor range, pick windy days - you'll be amazed at how well you shoot in a wind on a practice card; *that* will tell you something straight away.

Use your practice time to test your ammunition - don't leave it to chance; don't just stick to the same old brand: try different manufacturers, different grades or even different batches of your usual brand.

Seven: Take some time off.

This may appear to be in direct conflict with the previous tip, but so many people seem to get themselves into a hole and then keep on digging.

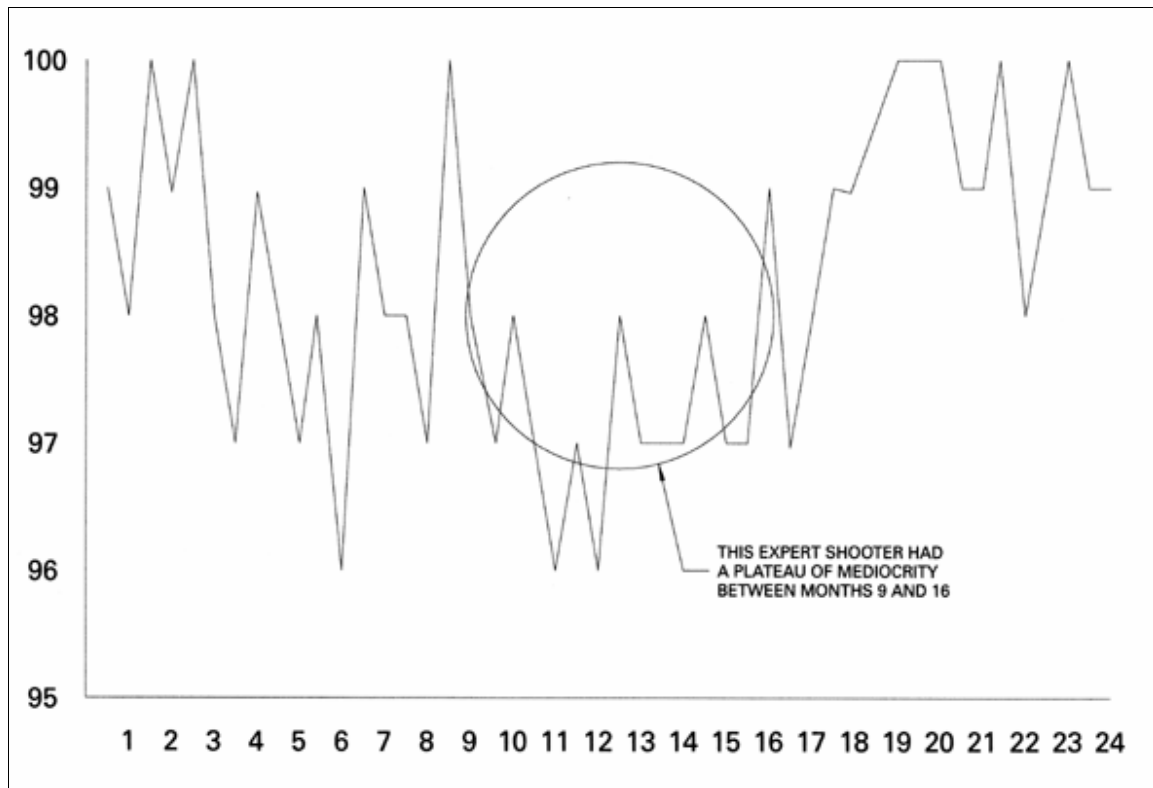
Don't give up shooting altogether; but if things get really desperate, try to go for a period of, say, six months without picking up your rifle (some addicts out there will find this difficult, but it can be done and it will be worthwhile).

Keep in touch with your fellow shooters and enjoy the relaxing atmosphere of your club without the pressure of analysing your scores; that can be a tonic in itself.

A number of people who've been forced to take time away from shooting through injury, or because their job takes them abroad, have returned without any loss of form and have gone on to shoot better than ever.

You could try taking off the winter months and then, two months before the start of the summer season, get in some serious practice.

Too much of a good thing (or of anything) can reduce your enthusiasm, and this could contribute to your arrival on the 'plateau'. Those of you in a rut *should* find something in the above tips to help you get your shooting going again, but if all the above fail then you may just have to accept that you've found your level in the sport.



Even top shooters have a plateau

However most of you - unless you're suffering from ill health or serious eyesight problems - are still capable of shooting better than you do, so don't give up because you're on the 'plateau'.

CHAPTER 22 IMPROVE YOUR SCORE

This section is not for those shooters of a nervous disposition, or anybody who is easily offended; now is the time to be rude about your shooting - *it isn't good enough!*

Hands up all those people who have just agreed! If you know your shooting isn't good enough, why aren't you doing something about it?

If you're a beginner with less than one year's experience, you have every excuse and hopefully this book will have helped you along the tortuous path in some small way.

Shooters with over four years' experience will have cracked the technique and should now be refining the finer points of beating their 'A Class' colleagues.

There's a great deal of difference between the four years of somebody who shoots two or three times a week, and the person who only shoots once a week; in fact, in the latter case the rise to the top could be delayed by several years.

Make no mistake - your rise to the top of the tree is entirely down to you; nobody else is going to drag you up the ladder - you're going to have to do it all by yourself. But if you're dissatisfied with your shooting, read on.

This isn't to knock you down, but hopefully will stimulate some thoughtful discussion around the campfire and eventually lead to some change of tactic, which may ultimately turn you into our next Olympic gold medallist.

OK, so it may take more than a few choice words to get you onto that podium, but Olympic gold medals certainly aren't won by people who think they *can't* do it.

How is your shooting? Does it leave anything to be desired? Is there some particular area where you're perhaps not absolutely one hundred per cent perfect? Could that area be worked on? How do you determine where you're lacking in perfection?

For those of you who've just said "everywhere", here's some good news: while nobody is perfect, most of you have large areas of perfection that you didn't know you had.

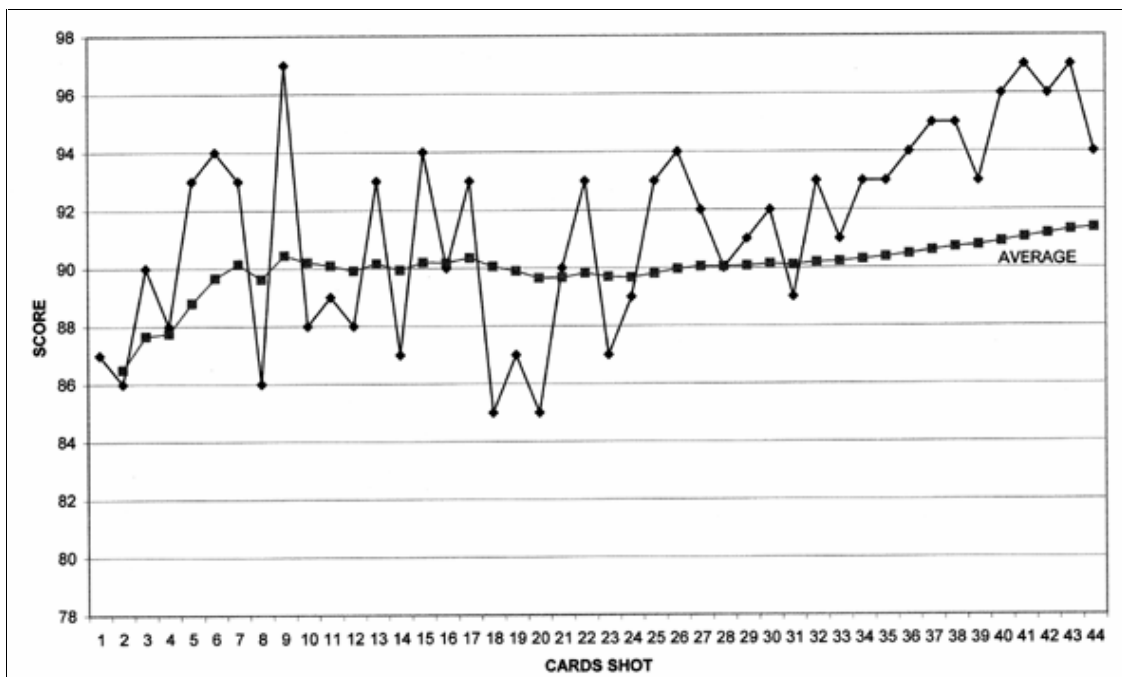
Just think about your shooting for a while; think how far you've come. You may think you're in the doldrums and aren't getting any better, but every time you shoot you learn something, it's just that you're not benefitting from it.

You're in a very difficult sport - and a minority one at that. But don't think that you're the poor relations in the shooting world; the reason why there aren't more people shooting smallbore target rifle is because it's too difficult.

Many people say that they used to shoot rifle but they got bored and moved onto something else, or they never started because it looked too boring. What they don't realise is that it's very difficult, and can only be done successfully by a very small band of people with patience, courage and determination.

As far as 'boring' is concerned, can you imagine anything less boring than the podium at the Olympic Games? It would be nice if you were there for the 100 metres (which would probably make you a lot of money), but medals are medals, and everybody who takes part in the sport knows what you went through to get to the top.

Firstly, let's pat you on the back for getting as far as you *have* got, as you've achieved a considerable amount. By just taking part in the sport you're showing a depth of character that many people lack; most people you pass in the street couldn't do what you're doing; it takes concentration, determination, courage, perseverance, precision and above all, a very good sense of humour.



Plotting your scores will show your upward progress

Now, down to the nitty gritty. What are we doing to do about *your* shooting?

The first thing to do is take stock of your strengths and weaknesses. You may have a particular talent for one part of the sport which you didn't know you had; you may also have a weakness you didn't know about, and most people tend to overplay their strengths and attempt to forget their weaknesses.

Let's just suppose for a minute that you earn your living as an engineer; that may be something you have a natural talent for, or that you enjoy doing; the chances are that you'll apply your engineering principles to your shooting, albeit unconsciously.

That can be bad news for you: shooting isn't about engineering - too much emphasis in that direction can lead you up the wrong path. Obviously everything has to work correctly from a mechanical point of view, but there's more to shooting than pure engineering.

Some brilliant shooters don't even know how their gun works; apart from knowing how to cope with basic mechanical failures during a match, they beat the competition on their shooting technique and experience, not by shimming the bolt to reduce the headspace by half a thou. to suit one particular batch of ammunition. (After all, you wouldn't expect a *Formula One* racing driver to turn up a new crankshaft on a lathe, would you?). So it is possible to engineer yourself *out* of the bull.

Sit down one evening and analyse your character to see whether it influences the degree of success you achieve with your shooting. We're not talking about one of those annoying newspaper questionnaires supposedly designed to determine whether you're God's gift to women/men, but a quite serious study of your own strengths and weaknesses.

Think about how your job might be able to help you in your shooting. Pretend you work in an industry that has those so-called efficiency experts who used to be called 'time and motion' men.

You may dismiss what they have to say about your job because *you* know how it should be done. But supposing they said something which could help your shooting. After all they're only interested in getting the maximum efficiency out of you and that's exactly what you'd like to do with your shooting.

However, if you're now thinking about signing up for a course in high-powered management training in the hope that it will improve your shooting, forget it; all it takes is commonsense and a little bit of intelligence.

The self-analysis that this type of course encourages isn't a bad thing, and you'd probably be told to start off by taking a blank sheet of paper and drawing a vertical line down the middle. Then you'd be asked to list all your strengths on one side and all your weaknesses on the other.

Of course, this is a fairly useless task in a general context - but supposing you did it in direct relationship to your shooting. What parts of your character would be advantageous to your shooting?

Are you fastidious?

Not many people would openly admit to that because they think makes them unpopular with other people and, carried to extremes it undoubtedly is, but it may well be an advantage to a shooter.

If you're forgetful, you could put that down as a weakness; there's obviously no immediate cure for a failing memory but, recognising that your memory is not what it should be, is the first step towards improving the situation, and the answer might be something as simple as a notebook and pencil.

Be honest with yourself - there's no point in ignoring the fact that you're inclined to be impatient because, while you're shooting, you'll occasionally let a shot go without waiting that little bit longer for the wind to come round and, of course, you get an 'eight'.

Your lifestyle will have a great influence on your shooting, but it would be extremely difficult to make any dramatic changes there.

If, for example, you're rushing all over the country (or the world) because of your job, then put that down as a weakness to be dealt with (for example, by shooting all your match cards during the less busy periods).

At the other end of the scale, a routine 9-to-5 job could also be a weakness because you get out of the habit of concentrating, so another interest which requires some brain exercise could help you to overcome that disadvantage (chess, computer games, a tactical sport, for example).

Supposing you're impatient - well patience can be learned; if you're careless you can practise taking extra care; if you rush around a lot, try slowing down for a while; if you have difficulty concentrating, then work on it - it will come with practice.

Don't worry if you've finished your list and found that you have a lot on the weaknesses side; with a little bit of effort you should be able to work on those weaknesses and turn them into strengths.

Here are a few other random examples, which illustrate the sort of thing which might influence your shooting:

Weaknesses

Difficulty concentrating
Demanding job, or self-employed
Unfit; high pulse rate
Indecisive
Forgetful
Impatient

Strengths

Experience - shooting for a long time
Good equipment
Supportive wife/husband
General good health
Don't smoke
Fastidious

It's fairly obvious what can be improved upon with a bit of effort. That doesn't mean that you should change your job but, by improving your general level of fitness (particularly if your resting pulse rate is more than 70 b.p.m.), you'll find it easier to cope with the stresses of a difficult job.

Previous chapters have already covered certain aspects of concentration and mind control, so you've only got to work on the indecisiveness. It's no use admitting that you've got a fault unless you're going to do something about it, so if you find that you're taking too long over your shooting because you keep hesitating about whether to let a shot go, enter some individual competitions and set yourself a specific time limit.

For example, do a 20-shot competition card in 10 minutes; some of your shots may feel a bit rushed, and you may lose some shots to the wind, but you will learn something each time you shoot and after a few goes, when you don't lose as many shots as you thought you would, you'll gain the confidence to make the right decisions and shoot more quickly when you need to.

So, sort out what your weaknesses are and work on them.

Most smallbore target rifle shooters in this country probably started off shooting the same way: they turned up at a rifle club as a complete beginner, some kind soul got them kitted out with a rifle, sling and whatever other equipment was available, took them into the range, showed them how to lay and what to look through, and then left them to it.

That system has actually produced some quite good shooters so, in the absence of any other way of getting started, it works after a fashion.

Most clubs have a band of experienced shooters available who are only too pleased to help, to pass on tips, and generally to get the *tyro* to the point of being a competent club shooter. The problem occurs when the beginner has the basics, has been shooting for a year or so, has reached a mid-90 average indoors, and now wants to go to the Olympics, or the Commonwealth Games, or wants to shoot for his/her country or county.

What do they do now?

The next steps are the most difficult, because the higher your average gets, the smaller the improvement you can make. If, for example, you shoot an average of 95, that could be made up of any score from 90 to 100, so if one card is a 90 you need to score that magic 'ton' to return to your 95 average.

However, as your average approaches that perfect score, you have less opportunity to make up for your bad cards, so if your average goes up to 98 and you then shoot a 95, you *can't* shoot a 101 to make up for it, so you need a 'ton' *and* a 99 to get back on course.

So where is all this leading?

Basically, if you want a 98 average you can't afford 'eights'; after all, if your rifle and ammunition were left to their own devices there wouldn't be any 'eights', so the answer must lie with you. What *you* have to do is recognise when things are going wrong and put them right before you have a disaster.

Supposing you have a 95 average and you've just started your card with a couple of bulls and a couple of 'nines' - so far, an average shoot; but then your fifth shot is an eight - that's four points dropped with five shots to go. If you were to continue with your average performance so far, you'd be about to drop a further two or three points.

That is the time to lift your shooting up a notch and shoot above your average; you *can* do it because you've done it before, and this time you only have to do it for the remaining five shots.

Shoot each shot as though your life depended on it; put the maximum effort into your concentration and put everything you've got into those last five shots. When they're all bulls and you walk off the range with a 96 instead of what could potentially have been a 93 or 94, you're going to feel pretty pleased with yourself.

If you were lucky enough to recognise why you got that 'eight' - fine, you won't do it again (will you?), or at least you'll have to find some other excuse next time. But don't just assume that, because you think you can stop any other 'eights' appearing on that card, that's the end of the story - you now have to stop producing a nine every couple of shots.

Some people will undoubtedly overwork those last five shots and perhaps drop points through trying too hard, but don't worry about that - this isn't an instant cure - nothing in rifle shooting works that fast. Just keep trying it and gradually you'll feel more in control and you'll learn to find just the right amount of concentration necessary to gain you those last five bulls.

The really bright, intelligent shooters out there are reading this and already probably moving on to the next point, which is of course: if you can do it for the last five shots, you can do it for the first five as well.

It's not as simple as that; you had the stimulus of getting an unexpected eight to wake up your concentration and get it moving, so what are you going to use as a stimulus when you *start* the card?

The answer lies in your sighting card: use your sighter to 'sight in' your concentration as well. Don't just fling a few rounds at it and then expect your concentration to suddenly, as if by magic, appear out of nowhere and remain at peak level during your match card.

Concentration needs to be eased into place and it has to be complete. You can't just think "I must concentrate on what I'm doing" and expect it to stay in your mind; it's not as easy as that.

Use your sighting shots to help concentrate your mind, work at those shots - every shot down the range will tell you something; listen to what those shots are telling you.

If you're zeroing in because you've been shooting at a different distance, then you have a lot of work to do, so you're going to be very busy for the first five minutes of your detail.

Don't just wind on a handful of clicks to see where the shot goes and then wind on some more. Calculate in advance how many clicks you think you need; were you right? Has your group moved as far as you thought? If not, why not?

Have you got the combination of windage and elevation right? (Rarely will you only need one and not the other). Have you settled down in the correct position? Does everything feel comfortable and in place? Is the sight picture right?

Are all your shots dropping nicely into the centre of the bull or is there a bias in one direction or another which you should be taking up with another click on the sights?

If your brain has to ask the questions *and* provide the answers, that's going to keep it fairly busy, but at least you'll have got its concentration capabilities working.

Here's a tip for those of you shooting indoors (it also applies to outdoor shooting, although not to such an extent): when you get down into position, be sure that you're getting into the right position for the match card, *not* the sighter. Line up your ideal shooting position with the card, rather than off to one side where the sighter is.

Lots of people will tell you to move your body between shots, which is fine if you can calculate the thousandths of an inch necessary, but most people will be incapable of making such minute movements with a large body. It's better to line yourself up on the centre of your match card and make the final small adjustments with your reloading elbow.

Don't get nicely centred on the sighter and then wonder why you're dropping shots when you get to the other side of your match card.

If you're already zeroed in at the range you're shooting, you won't need so many sighting-in shots, and this is the time when it would be very easy to get blasé.

You still need to work at your sighting shots: they can tell you if you've got down into the right position. If your group isn't in the same place as it was before, why isn't it? Perhaps it would be better to get up and get down again, rather than starting to adjust your sights, in case you've simply got down in the wrong position.

Of course, you may have sighted in incorrectly on the first card and you're now in the *right* position, but that's all the fun of shooting, and you really should get it right the first time!

It's very important to be prepared mentally if, for example, you're half way through the winter season and you suddenly have to make some major adjustment to your sights ('major' means more than the odd click or two); it could be that you've inadvertently altered your position and are now zeroing in on a false position. The time spent on your sighter is the time to think about what you're doing.

By keeping your brain alert and concentrating on the task in hand you can be prepared for changes which shouldn't have occurred.

The other advantage to having a sighter card is to get you into a rhythm. There's no need to shoot to a rhythm to the exclusion of all else, but by concentrating on each shot on the sighter you're rehearsing the way in which you'll shoot your match card.

During this time you're also settling into position, so put about five shots on the sighter before you start on the match card, even if you're totally convinced that you're accurately zeroed in.

Some people just want to get on with it, rather than 'wasting' time on the sighter and if you're a top shot and are *that* confident of your ability, by all means go ahead. Just remember that the single shot which took out the dot on your sighter, *may* be the one wild shot at the edge of your group!

Always think in terms of your whole group, not just of individual shots, even on a 25-yard card. When you're sighting in, work at moving your group, not single shots; it takes at least three shots to tell you where - and how big - your group is.

Thinking about your group while you move around the card is vital; it's relatively easy outdoors because you get enough shots at an aiming mark to see your group forming, but it can be more difficult indoors because you're usually only firing one shot per diagram, so it's even more important to watch where your shots are going.

It's amazing how many points are lost, particularly amongst those club members with lower averages (although it's by no means confined to them) because their group is too high, too low or off to one side. Making an adjustment of a click or two during a card could easily save a disaster.

That doesn't mean that you shouldn't start chasing every shot with a sight adjustment - that could lead to an even greater disaster. I'm talking about reading your card and noting, while you're going from aiming mark to aiming mark, whether all your shots are ending up to the left or right of the dot, or high or low.

Most points are lost by groups being low then high, rather than left or right; perhaps it's because people are more conscious of their group slipping off to one side.

A top shooter with the right equipment should be capable of shooting a group no bigger than a quarter of the size of the bull, whatever the range. With that in mind, you should have plenty of room to make adjustments if your group starts to form too close to the nine ring.

For all those potential top shots out there, if you can get five shots between the dot and the nine ring without touching either, and between 3 o'clock and 6 o'clock (or any other quadrant), then you're starting to get somewhere!

CHAPTER 23

CLEANING

The controversy over how often a .22 target rifle should be cleaned has raged for many a long year. If you were to carry out a survey amongst your club members, asking a question like “How often do you clean your rifle?” you’ll probably get answers like “every so often”, “never” or “every time I shoot”.

Everybody seems to have a different idea of how often it should be done and, what’s more, they also have different ideas about *how* it should be done.

In the old days, before the advent of the modern smokeless non-corrosive ammunition which is used these days, it was essential to clean out gun barrels, otherwise they became so clogged with debris from repeated firing that they wouldn’t fire at all.

The main original reason for regular cleaning of modern rifle barrels was to avoid corrosion, caused mostly by the fact that primer compounds contained potassium chlorate, which produces potassium chloride when fired. This, as you may well know, is very similar in nature to sodium chloride, which you sprinkle all over your fish and chips, along with acetic acid (vinegar).

One important and damaging property of potassium chloride is that it is hygroscopic, i.e. it attracts moisture. Therefore, if it’s left in a rifle barrel in a humid atmosphere, it will very quickly attract water to the steel (and you can imagine what salty water does to steel!)

In those days of corrosive primers, the best cleaning agent was actually water, because potassium chloride - like ordinary table salt - is soluble in water. But riflemen had an aversion to cleaning their barrels in just plain water, and the manufacturers very soon produced cleaning oils which were a combination of oil and water. (In case you thought oil and water don't mix, let me assure you that some do).

Because the water was notorious for finding its way into cracks and crevices in firearms, and was then extremely difficult to remove, the emulsion of oil and water worked very well - the water dissolved the salt and the oil stuck to the metal to protect it.

If you were wondering about the relevance of this chemistry lesson, then look at the back of a can of *Youngs 303* - one the most well-known cleaning oils used by smallbore target rifle shooters. There you’ll find a formula for ‘Aquaoil’, which is three parts water mixed with one part *Youngs 303*. Now you know why they recommend it be mixed with water.

Nowadays all smallbore target ammunition is non-corrosive, so there's much less of a problem, which is why one particularly well-known top shot in this country claimed not to have cleaned his rifle for twenty years!

So if you don't *have* to do it, why do it at all? Well, some people can't bear the thought of using a dirty tool and, as an attitude of mind that's difficult to argue with. It shows a care and love of the rifle which brings its own rewards; psychologically they will feel that it shoots better for them and, of course, it *may* actually do that (or not - as the case may be).

Other people are of the opinion that while the rifle's shooting all right, leave it alone, don't disturb anything; that also has psychological benefits to some people. Then there's the problem of deciding what is clean and what isn't. Some shooters will scrub vigorously, others will just run a patch down their barrel, but who is right?

The shooter who cleans his rifle every time he shoots may only pass a dry patch down the barrel to remove the powder residue; in his mind his barrel is then clean.

Somebody else will scrub the barrel with brushes and solvents before accepting that the barrel is clean. There is, of course, one concrete and definite answer to all these questions, which will tell you exactly how much and how often you need to clean your rifle, and that nugget of valuable information will be imparted later, but first of all let's delve into the alternatives available.

You have to understand a little bit about what you're doing and what you're trying to achieve before you can set about cleaning a rifle.

Let's take the barrel first. It's difficult to see very far down the inside of a .22 rifle barrel, but if you hold it up to the light it will look very dark and dingy, and (if you've just finished shooting) will have a residue lying along its length. One sweep of a dry patch down its length will leave most barrels looking like new, but does that mean the barrel is clean?

When your barrel is rifled, it's done with very hard tools which leave tooling marks on the surface of the steel in the rifling. These marks are real traps for any muck and rubbish which you happen to throw down the barrel (with due respect to the ammunition manufacturers).

A quick sweep with a brush or a dry patch will remove all the loose debris, but is that all that's necessary? In case anybody is beginning to wonder why there are more questions than answers, it's because it's intended to get you, the reader, to think about what it is you're doing.

It would be an unusual rifle barrel that didn't collect a small amount of lead somewhere: you can't send lead bullets - down a barrel at high speed, high pressure and high temperature without expecting some sort of lead residue to be left behind. Of course, it may then be removed by the next bullet to come along, and that in turn may deposit its own trail of lead, and so it goes on.

If we could rely on this procedure of deposit and removal always being consistent and equal, then we would have no problems, and things could be left as they are, but as with most things in life, it's never that simple. Most modern .22 bullets are very well lubricated and that does keep the leading problem to an absolute minimum, but if a rifle has a serious problem with its barrel leading up, this can show up on the target.

Suppose, for example, that there's a particularly bad tooling mark in the rifling which is bad enough to take lead off a bullet; that lead, instead of being taken out by the next bullet, could actually be forced further into this crevice, and take more lead off the next one.

Eventually, after this process has been repeated a few times, the lead build-up finally gets ripped out by a bullet because it's grown too big. This all results in shots gradually climbing up out of the bull and then suddenly dropping back down again, or a sudden apparently 'wild' shot, with the next few also being out, until they settle down again into the bull two or three rounds later.

If you suspect that you're getting any of the above symptoms, it would be worth you giving your barrel a thorough scrub with a lead-removing solvent to see if that improves the situation (or makes it worse). If you haven't already got one, then get yourself a plastic-coated .22 cleaning rod - *Parker Hale* make one that is suitable - with a revolving handle so that the rod turns round to follow the rifling without you having to twist your hand.

If you intend to do any serious scrubbing of your barrel, that means a phosphor bronze brush. Don't be put off by its wiry appearance - the bronze wire is much softer than the steel of your barrel and will do it no harm at all.

A suitable lead solvent might be *Hoppes No.9* or *Parker-Hale 009* - both are designed to remove metallic fouling from barrels - they both attack non-ferrous metals and won't harm the steel of your rifle.

Do use a cleaning rod guide if you can get one to fit your rifle. This will be a tube made of plastic or aluminium, with a .22 hole down the middle and the outside will be shaped like your bolt so that it can replace the bolt in your rifle. It makes presenting cleaning implements to your barrel much easier, and tends to protect the trigger mechanism from flying droplets of oil and dirt.

Never clean a rifle barrel from the muzzle end - that is the most delicate and important part of your barrel and any damage in that area caused by the careless use of a cleaning rod could affect accuracy. If you intend to do a thorough cleaning job, it would certainly be a good idea to remove the stock, and take off the trigger if possible; that makes life so much easier.

With a *BSA* you'll need to remove the action; with an *Anschutz* you should remove the bolt. You may even like to remove the little shiny floor plate, which is held in place by the ejector kicker and a little spring clip under the receiver - that saves solvent finding its way underneath where you can't get at it.

Make sure your cleaning rod is straight, as a bent one will be much harder to use and control, and it will rub all the way up the barrel, leaving bits of plastic behind. Dip the phosphor bronze brush in the solvent and give it a good steady push up the barrel until it completely clears the end of the muzzle, then pull it all the way back and withdraw from the chamber. (It's not a good idea to do this on the kitchen table as metal solvents tend to have fairly pungent chemicals in them and will certainly make a mess of linen tablecloths.)

When the brush clears the end of the muzzle it will tend to spray oil in all directions and whereas *you* might quite like the smell (in fact perhaps that's why some people clean their rifles so often), other people don't.

Several passes of the brush up and down the barrel will remove most of the lead contamination, but that will vary from barrel to barrel. It's quite acceptable to leave the solvents in the barrel, because, as mentioned earlier, they don't attack the steel.

So, over a period of time you could vary the speed and timing of your brushing to see what produces the best results; you could, for example, leave the solvent in the barrel for an hour or so after the first brush-up-and-back, to see if it comes up cleaner.

It's difficult to get any speed going in view of the length of the barrel and the spindly nature of the cleaning rod, so be patient: 'slow and careful' is the name of the game. After you're happy with your brushwork (and it would be a good idea to make a note of exactly what you did so you can remember for the next time) you need to remove all that wet gooey muck from your barrel.

There are two ways of doing this:

Firstly there is the time-honoured method of *Forbytoo* and a jag. Wrap the patch of *Forbytoo* around the jag (this is where you'll find the rod guide useful, because it's at the back of the action and convenient to get to) then push the patch up and down the barrel. However, this time don't allow the patched jag to come out of the muzzle, because *Forbytoo* has a habit of unravelling when you least expect it.

Keep passing more and more clean patches up the barrel until they come out clean. (N.B. if you're using an aluminium rod guide, the patches will never come out completely clean).



A typical cleaning kit

The alternative to patches is the VFG system of cleaning felts. This requires a small adaptor as shown in the photo and the small .22 diameter round felts with a hole in the middle.

The first felt screws onto the adaptor, and a second is pushed on behind it. The felt on the end sweeps all the main debris out of the barrel as you push it through and out the muzzle end. As you pull it back, the dirty felt then falls off and the one which is screwed on can be pushed and pulled up and down the barrel, absorbing the oil as it goes. These are much quicker and easier to use and are readily available from good target shooting shops.

The exact formula for how often your rifle should be cleaned is as follows: *clean your rifle as often as it needs cleaning* - no more and no less. Before any of you shrug your shoulders and turn away in disappointment, the secret is in deciding how often it needs cleaning; the critical factor here is the *effect* that cleaning has on your rifle's accuracy.

There is obviously no easy way of measuring the accuracy of your barrel other than shooting it and keeping a careful note of how it performs at various stages in the cleaning process, so that's what you're going to have to do in order to define the exact process by which you maintain maximum accuracy.

If you ring up a barrel manufacturer and tell him your gun shoots better if it's left dirty, and it shoots worse every time you clean it, he'll probably tell you that you need a new barrel.

If you ring another barrel manufacturer, and tell him the opposite, i.e. it shoots better after you've cleaned it, he'll probably tell you that you need a new barrel as well.

If you then get a new barrel, you could find that it shoots better when it's clean, or you may not! (Unfortunately this is not an exact science and you have to spend time working out your own formula.)

There is one argument that says the newer the barrel is, the more it will require cleaning because it will have manufacturing marks left on the inside which attract dirt. Then, as they get smoothed down and polished with use, they are less likely to retain muck and rubbish from firing.

Working out a cleaning formula must come as a result of you analysing your shooting, and to do that you must be critical of your group size.

Let's start from the beginning. Clean the barrel thoroughly so that you're sure you've removed all the lead and residue from previous firings.

Now take your rifle to the range and shoot it at one diagram (preferably at 100 yards), keeping a mental note of where each shot goes right from the beginning. If your rifle shoots right in the middle of your group with the first few shots - fine; if not, then make a note of how many shots are necessary before it settles down to its normal group size.

Some rifles may take up to 20 shots or more before they settle down, others may only take one or two. What is important is to learn exactly how your rifle reacts.

After you're confident that your rifle's shooting to its group size, get up and clean it again, only this time just pass some patches or felts down the barrel with a drop of cleaning oil, like Hoppes No.9, or Youngs 303; dry it out with clean patches and then get down and see how it shoots on another diagram.

Keep a note again of how it performs and after you're sure that it's shooting its normal group size, get up and clean it again, only this time just pass one dry patch or felt down the barrel to sweep out the residue; then get down and shoot it again.

At the end of this third exercise you should be getting some idea of the degree to which the various cleaning processes affect your rifle.

The next test is to extend the number of shots between each cleaning stage and see what effect this has.

Over a period of time you should be able to build up a pattern which will tell you exactly how often and how much you should be cleaning your barrel.

You might find, for example, that if your rifle takes a long time to settle down you may not want to clean it very often. On the other hand, if you detect an enlargement of your group which magically shrinks when you clean the barrel, then you may want to clean it fairly regularly.

By now you should be getting a clue as to why there are so many differing ideas about when and how often to clean a barrel, but you should also now be able to work out your own formula instead of blindly following what your resident club expert tells you to do. Just choose the system that produces the best grouping results in your rifle.

Having sorted out barrels, there is actually more to cleaning a rifle than just keeping the barrel bright and shiny. Unfortunately the little .22 round is one of the dirtiest to fire, but don't be alarmed, 'dirt' isn't really the right word.

Parts of the rifle may get 'mucky', but that's because .22 bullets are normally covered in lubricant, some of which gets scraped off each time you place a round in the chamber.

It may look awful, but at least it *is* a lubricant; unfortunately it gets mixed with the burnt powder residue which is not only left inside the barrel, but also falls out the back as you extract your empty case after firing. This residue can feel hard and gritty after a time and, mixed with the lubricant, could form a sort of mildly abrasive grinding paste, particularly if you shoot indoors in a dusty range.

Having now created a very black picture which made you all rush out for your cleaning equipment, let me put your mind at rest: your rifle is built to withstand 8 tons per square inch of pressure, and the front face of the bolt (where most of the muck collects) is hardened (and it doesn't rub against anything else anyway), so it would take more than several years' accumulation of gunge before there were any serious implications in terms of wearing out your rifle. Not even Martini actions would be affected to any great extent.

What is more important is the possible effect on your headspace - that area between the back of the barrel and the face of the bolt which holds the rim of the cartridge.

Any dirt in that area could soften the blow of the firing pin and affect the speed of ignition, which could result in a variation in velocity.

It's always worth keeping the front face of the bolt clean, as well as the rear end of the barrel (particularly the extractor slots, which seem to be neat little receptacles for bullet lubricant and powder residue).

The extractors themselves carry on working satisfactorily for ages until suddenly they become so gunged up with muck that they stop altogether.

When you do clean them, be careful how you remove them as they're worked by little coil springs and plungers, which delight in flying across a room and disappearing into the carpet.

Martini action owners can drop the action out of the rifle to get at the end of the barrel and the inside of the trigger, which is an area that must be kept scrupulously clean. Some *BSA* triggers have been known to stop working properly just from an accumulation of gunge.

The new *Anschutz* triggers (ones produced after 1976) are very exposed to the elements, so the next time you have the barrel and action out of the woodwork, have a look at the trigger.

There are a lot of delicate levers and springs inside which don't like dirt, so a very gentle but thorough clean would not go amiss. You'll find an aerosol degreasing fluid very useful here.



Clean that trigger regularly

Don't over-oil the trigger when you've finished cleaning it, as oil just attracts more dust and dirt. If necessary you could put the slightest smear of molybdenum disulphide grease on the sear and the merest hint of oil (about the size of a pin head) on the pivot pins, but that's all.

If you feel confident about taking a Martini action apart to clean it, then do so, but be warned, the extractor spring is very strong and needs to be compressed during disassembly. (Gun shops love being handed a bag of bits and asked to re-assemble them - they charge a fortune, so you've been warned!)

Disassembling a bolt from an *Anschutz* or *Walther* is relatively straightforward and the more times you do it, the easier it gets. Just remember as you take off each part, lay it down the right way round, with each piece in order, so that when you come to re-assemble the bolt you pick all the pieces up the right way round in reverse order.

If you have a rifle with a fully floating barrel - that means all *Anschutz* rifles since 1954, *Walthers*, and *BSAs* since the Mark III- then you'll need to keep the area under the barrel very clean; any accumulation of debris lodged between the barrel and the forend woodwork could seriously affect barrel vibrations and hence the accuracy.

You should be able to pass a piece of paper down between the barrel and the woodwork - minimum thickness should be that of a target.

One area very often neglected in rifle cleaning is the sights. Some people religiously clean their barrel every time they shoot, but ignore the fact that their sights are full of dust, hairs and all sorts of rubbish. A hair lodged across your rearsight aperture will interfere with your sight picture, and consequently your scores, much more than a dirty barrel.

Camera shops are good places to find cleaning equipment for your sights - they sell all sorts of little brushes with rubber bulbs on them for puffing air through the bristles. They also sell aerosol cans of air, but these are horrendously expensive, although they can be useful in an emergency.

Anything used for cleaning a delicate piece of equipment like a camera is going to be all right on your sights.

Be warned, however, about attacking your sights with a cocktail stick and a bit of rag or cotton wool. The last two have the habit of leaving bits of thread behind (with the possible same disastrous effect as a hair) and the last thing you want is a splinter sticking out of your rearsight.

If you have an adjustable iris rearsight and colour filter set then these are very delicate precision instruments and, as such, need specialist treatment when cleaned.

They *can* be taken apart, but only with extreme care and in a very clean environment. Some of them have springs, ratchets and filters no more than 5.00mm across so if you don't feel confident about tackling a complete dismantling and reassembling exercise, just content yourself with a quick blow out.

Don't forget the foresight, which presents a wonderful little hideyhole for the odd passing spider and if you have an adjustable iris foresight, be careful how you clean it - the leaves in the iris are very easy to displace.

If you're in the habit of liberally spraying *WD40* or an aerosol oil all over your barrel, take the foresight off first, or at least cover it up. This is particularly important if you use perspex foresight elements, or an adjustable foresight with a perspex insert, as the oil will leave marks on the plastic. If this does happen, they *can* be removed with a cocktail stick and tissue paper but, again, extreme care is required.

The woodwork on most target rifles is varnished and so requires very little maintenance. You can wipe it over occasionally with a cloth, but don't use a silicone cloth, as this will tend to make it slippery.

To summarize, then, clean your rifle barrel according to how it shoots and give the rest of the rifle a thorough clean, say twice a year, keeping your eye on your sights for stray foreign bodies, particularly if you come back from a windy, dusty, wet or mucky open shoot.

Wipe the outside of the barrel and the receiver regularly with an oily cloth, and those of you who insist on carrying your rifle at its point of balance (i.e. with your thumb wrapped over the top of the receiver) please check for rust spots where you leave your thumbprint. You may not think your hands are sweaty, but you'll be amazed at the damage you're doing to the outside of your barrel by not wiping it down after handling.

CHAPTER 24

BEDDING AND VIBRATIONS

BEDDING

Most smallbore target rifle shooters nowadays use rifles that have fully floating barrels. That means there's no connection between the barrel and the woodwork of the stock, the theory being that the barrel is then allowed to vibrate and recoil completely freely, without hindrance or any stiffening from the stock.

This means that the only connection the barrel has with the stock you're holding is through the receiver (the part of the action which houses the bolt in a bolt-action rifle).

Later *BSA Martini International* rifles work on a different principle, where the forend is constructed around a beam, which cantilevers out from the action underneath the barrel.

The receiver starts out life as a steel tube which has large lumps machined out of it, thereby reducing its overall strength considerably.

This tube of steel is fairly substantial as a piece of metal on its own, e.g. in the *Anschutz Match 54* action the receiver has an overall diameter of 30mm, with a 16mm hole down the middle. This sounds quite substantial, but it has also undergone a fair amount of machining to make way for the bolt and barrel, so instead of weighing 750 grammes, it only weighs about 500 grammes.

This still sounds considerable until you consider that it's trying to support a barrel which is recoiling and vibrating, and weighs some 2,500 grammes - approximately 5 times the weight of the receiver and 3.5 times its length.

If you could clamp the receiver so that it was totally immovable, you wouldn't care how much the barrel moved or vibrated, as it would be consistent, and that's what you're after while you're shooting.

The only inconsistency which could creep in would be the way the barrel is fixed into the receiver.

No rifle manufacturer is going to leave a barrel flopping about in an action, so you can rest assured that, no matter how your barrel is fixed into your receiver, it's as firm as if it was machined out of solid metal with no joint at all, so every vibration of the barrel is transferred *directly* to the receiver.

In most bolt-action rifles the receiver is bolted down to a block of wood (the stock), but in the interests of low barrel lines, the receiver is then let into the wood, which is routed out to receive it.

Consequently, the wood surrounding your receiver is, by comparison, fairly thin and therefore flexible. Most decent target rifles use walnut stocks because walnut has the ability, owing to its molecular structure, to absorb recoil very well.

However, much of that ability can be lost if your receiver isn't connected to the woodwork, and/or the grain isn't true or straight and close.

Choice of woodwork is something you don't normally get when selecting your rifle, but it would be difficult to know what to look for anyway. Therefore, a certain element of luck appears in the equation, i.e. how well does your receiver fit into your woodwork?



The receiver is pulled down into the woodwork with bedding bolts like these

In the bad old days, it wasn't uncommon to find a club member wrestling on the clubroom floor with his rifle and the largest screwdriver he could find, attacking the bedding bolts in an attempt, by tightening them as far as possible, to force the receiver down on to the woodwork to form a solid bed.

That's one way of tackling the problem, but unfortunately it does have its drawbacks.

There have been cases where the stock has been crushed to a dimension the same as the effective length of the bolt; in other words, the bolt has 'bottomed' in the hole and, however hard it's turned, it won't tighten any further on the woodwork.

Increases in humidity and temperature make a wooden stock swell and shrink, thereby altering the tightness of your bolts on the woodwork and, therefore, the tightness of the receiver in the action.

When you fire your rifle you release a considerable amount of *energy*, and that energy is absorbed by you and your rifle. Part of that goes in a twisting motion, because you are forcing a lead slug down a corkscrewed tube with approximately 120 ft. lbs. of energy, but because the bullet is so much lighter than the barrel, the barrel tends to stay where it is and the twisting motion is applied to the bullet.

If the situation was reversed and the barrel was lighter than the bullet, the barrel would be twisted out of its bedding. As it is, you hardly notice any effect at all while you're shooting - all you feel is a small amount of recoil. However, should your barrel be screwed into the receiver, and screwed the wrong way, then you could find it unscrews itself and eventually falls off while you're firing.

Don't worry! Most modern smallbore target rifles are pinned or clamped in place and even if you've had a new barrel fitted and it's screwed rather than pinned, you can be sure it will be screwed the right way round.

Going back to the weight relationship between the barrel and the receiver, if you impart energy to the barrel, some of that energy is going to be transferred to the receiver and there could be a tendency for that twisting motion to want to twist the receiver out of its bedding.

That 120 ft. lbs. of energy is largely dissipated by the time it gets to trying to turn your receiver around in your stock. Nevertheless it *is* still there and, in a stock which isn't bedded to the receiver very well, the only thing which might be stopping the receiver from turning could be the bedding bolts, because they've reached the edge of their holes.

If all you were concerned about was the fit of the receiver into the woodwork, then there's a simple and inexpensive solution to the problem.

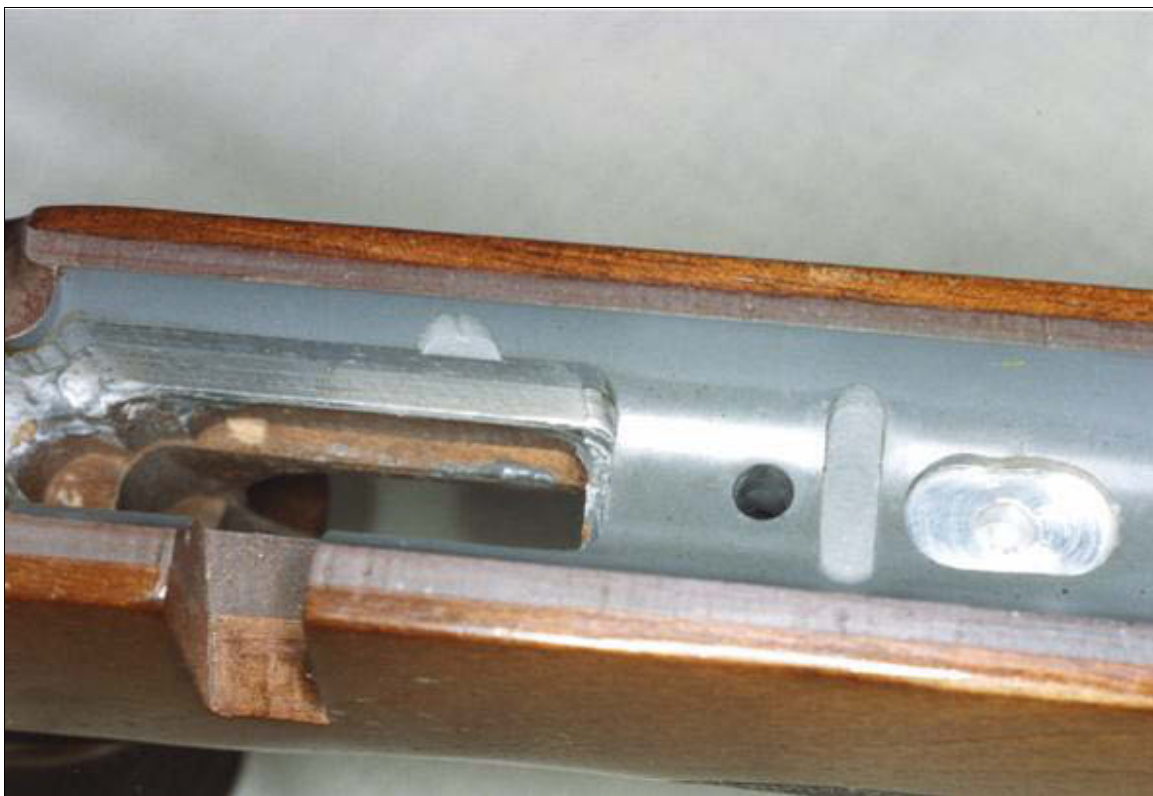
All you need is a thin, soft, malleable substance which, when placed between your receiver and the wood, will squeeze up when the bedding bolts are tightened, and take up all the space between metal and wood, to provide a uniform bed.

Whatever you use must be capable of setting hard, so these new epoxy resins are ideal, although people have used fibreglass and balsa wood soaked in glue. However, don't forget to use a releasing agent on the receiver in case you ever want to remove it from the woodwork.

Well, that solves the problem of wood-to-metal fit, but what about stiffness?

However well the wood fits, it isn't going to add a great deal of stiffness to the action if there isn't very much wood there to start with. So what happens if you rout out more wood underneath the receiver and replace it with an epoxy resin with a metal plate embedded for extra stiffness?

Now you're talking about spending a bit more money, because this sort of major alteration should be left to an expert, but it does kill two birds with one stone: it stiffens and strengthens the receiver and provides a uniform and inert bed.



This epoxy bed also has a metal plate for stiffness

All this may seem unnecessary, but if you try thinking of it in terms of the amount of force which is hammering away at your receiver every time you pull the trigger, then you may be surprised.

The average .22 round produces about 120 ft. lbs. of energy (that's very approximately equivalent to dropping a 12 lb. weight from 10 ft.) so think of the number of times you pull the trigger on a live round - perhaps 5,000 times a year.

If your rifle is, say, 10 years old, simple arithmetic will produce a startling result in terms of the amount of energy, which you've been expecting your rifle to absorb without complaint or movement: in total you're talking about dropping 2500 tons onto it. (Obviously this is a nonsense figure, but remember the impression dripping water makes on a stone over the years.)

By stiffening up the whole area, and improving the joint between wood and metal, you're spreading the load more evenly and removing a weak point in your rifle.

The next question of course is: if it's that good, why don't the manufacturers do it? Principally because it's too expensive, and because they consider it to be the 'icing on the cake', i.e. possibly improving an already splendid product, but *you're* looking for every point, aren't you?

You should be in the business of trying to remove variables in your constant search for improvement, so if you can remove a variable by having your rifle bedded, that might make it worthwhile.

It's not, however, the whole answer - things are never *that* simple in the world of smallbore target shooting.

You can't expect bedding to solve all your problems and suddenly tighten your groups up to 'X Class' standard, as there are other variables closely allied to bedding which, if not tackled at the same time, may reduce its effectiveness.

These all involve the barrel vibrations, the torque settings and selecting the right ammunition; in other words 'fine tuning' your rifle to shoot better groups than its 'out of the box' group.

Having decided that you would like your rifle bedded, the next step is to find a gunsmith to do it for you. The best way of doing this is to examine as many rifles which have already been bedded as possible, and ask their owners who did it and whether they think it was successful.

Some people like more than just the receiver bedded and they go up the first inch or so of the barrel as well. However there may not be any major benefit to be gained from this, as it does remove part of the barrel's ability to be fully floating.

Asking several people how they get on with their particular version will help you to make up your mind but, like most things, the proof of the pudding is in the eating. At least if the bedding's gone too far, it's probably easier to remove it than it is to start adding lumps of epoxy compound to the underside of your barrel.

This would be the time to start experimenting with the torque settings of your bedding bolts, now that you can pull them down onto a nice inert bed which doesn't move, expand or contract with every change in the weather.

First acquire a good accurate torque wrench, either by borrowing one from a club member, or buying one yourself.

Anschutz make one which will be available in your local gunshop, but be warned that it only comes with an allen key fixing, so if you still have screwdriver slots in your bolts, you may need some form of adaptor as well. A British firm called *M.H.H. Engineering* also makes a very nice little torque wrench, which takes normal BRITTOOL bits (readily available in good tool shops).



A torque wrench is essential if you're going to experiment with different settings

As you can imagine, finding the right torque setting for your rifle is a matter of getting down on the range in the best weather conditions you can find, with a well-tried and trusted batch of ammunition, and experimenting until you come up with the tightest groups you can.

Start off with a torque setting of, say, 5 NM (which is what *Anschutz* recommend) and go down by 0.5 NM and see if your group tightens or enlarges. Don't go any lower than 3 NM (you're unlikely to be getting any tighter down there any way, because you run the risk of the bolts vibrating themselves loose). When you've done that, go back to the beginning and go up in 0.5 NM steps.

Keep records!!!

Those of you who are statistically inclined might like to plot a graph of group size against torque setting.

The reason for experimenting with torque settings is because the barrel vibrates; most people are probably prepared to accept that a 660mm long bar of steel 23mm thick, clamped at one end only and then thumped with a considerable force, is going to vibrate. The question is: how much does that affect the group size, if at all?

Undoubtedly it does affect *something* but does that make it more - or less - accurate? To find an answer, first of all you need to go back to basics and decide to what extent the barrel does vibrate.

If you were to clamp one end of a 600mm long steel bar into a substantial metal vice and hit it with a hammer, you would certainly see it vibrate. However, the amount of vibration will depend on where you hit it; for example, if you went for the furthest end from the vice and attacked it in a sideways direction you would see quite a substantial vibration.

However, hitting it with some force at the other end, in line with the long axis, will not produce the same amount of vibration. This may all sound all very obvious to anyone with an Honours Degree in Physics, but everyone else will need to have some conception of what kind of vibration we're dealing with and whether there's any advantage in trying to stop it.

Further experimentation will show that clamping the piece of steel between two pieces of wood reduces the vibration even further, possibly because the wood dampens down some of the vibrations. There's also the possibility that holding the vice in your hand instead of fixing it to a bench (not easy!) may mean that the steel doesn't vibrate at all.

Steel is a relatively elastic material, i.e. it can be bent to a certain extent and it will spring back (unlike lead for example). Just suppose for a moment that your barrel was made of lead and your bullets were made of steel; you would - quite rightly - expect your barrel *not* to vibrate.

However, with a steel barrel and a lead bullet, the ignition from the cartridge slams the bullet forwards into the rifling, which sends stress waves flying up and down the inside of the steel barrel; however, they will be travelling *straight* up and down the length of the barrel.

At the first ignition of the charge in the cartridge, the bullet and case separate and the case is forced back against the bolt face. It's then forced open to seal against the chamber walls, which enables the pressure to mount enough to start driving the bullet down the barrel; all this produces an effect already known to us - recoil.

Recoil acts straight backwards until it meets resistance (i.e. your shoulder); then, because the barrel is above the point where you're holding the stock, the muzzle starts to lift. It is, of course, restrained by your sling, which prevents it from lifting very far, and, as you've no doubt observed through your sights, the barrel very quickly returns to its original line.

If the sling holds it down, the barrel (which isn't attached to the stock at the forend) could move further than the stock. However, as it's fixed at the rear end, the inertia in all that steel may cause it to bend up as it reaches the limit of its upward travel, and then bend further downwards as it returns to its original position.

This could certainly cause a vibration, but is it *after* the bullet has left the muzzle?

As the bullet is only in the barrel for three thousandths of a second, this is distinctly possible (the bullet leaves the muzzle while it's still rising, which is why faster ammunition shoots lower on the target - in most cases).

At the moment of trigger release, when the firing pin smashes into the back of the cartridge case, there is an immediate small vibration set up, dampened slightly by the brass rim absorbing some of the impact as it deforms.

Then there's a very dramatic blow to the back of the rifle, which in a bolt-action rifle, would send the bolt whistling past your ear if it wasn't locked down.

That blow sends stress waves flooding up and down the barrel, which must create vibrations, but are they necessarily going to make the barrel vibrate off its centre line, and if they are, will there be as much sideways movement as vertical?

We know that under recoil the lift and drop of the barrel is not truly vertical - it's more of a little circular movement - but you have to remember that, because the barrel is rifled, the bullet is imparting a twisting motion to the barrel.

So, bearing in mind the earlier comments about vibration being dampened by wood, and the effect if the vice was hand-held, you would expect the vibrations in the barrel to be considerably less because it would be quite free to move after it was hit.

In the case of a target rifle, the *whole thing* moves rather than having one end clamped in an immovable vice, when the barrel has no choice but to bend and, consequently, vibrate.

If you strike a tuning fork, it vibrates with the same frequency (and consequently the same sound) whether you hold it in your hand or on something hard and solid. The solid object just acts as a sound board so you can hear it better.

However, you won't get much of a note out of a tuning fork if you strike it on its end - you have to strike it at right angles to its long axis to get the best effect.

So if you assume that barrels do vibrate you then have to consider what shape that vibration takes.

If the barrel is fixed at one end, that will be a 'node point' (or stationary point), but is that the only node point, or are there others?

There are all sorts of theories regarding how to find other node points (which involve the use of iron filings, flour, steel rings), all working on the basis that, if the barrel snakes up and down, there could be a point which appears stationary.

However, it can be difficult to get your brain around the idea that a one inch thick bar of steel with a little .22 hole down the middle will start snaking up and down, just because it receives a hefty shove at its back end, while being supported by a very soft pliable material (you, the shooter).

It's true that, if you suspend your barrel from something which allows it to move freely, and then gently tap it along its length, it rings like a bell. That's no surprise, of course, as that's exactly what a piece of steel would do. It also vibrates with its own natural frequency, which is dependent on its shape, mass and material. Obviously that's why tuning forks are produced in different sizes for different pitches if they're made of the same material.

It's also true that you may find a point down that barrel where tapping it produces a dead effect - possibly somewhere in the middle - but as soon as you grab the receiver in your hand, the sound goes dead and the vibration stops. Tapping your barrel while it's in the woodwork produces nothing - it sounds dead - which presumably means that the wood is dampening any vibration.

If you accept that a piece of steel held in a vice and then struck, will vibrate, you'll probably also appreciate that the greatest amount of vibration is at the furthest distance from the vice.

If you were to clamp a weight to the furthest end, the vibration would be less if it was struck with the same force, because you've increased the inertia of the steel at that end. That's why *Anschutz* have, in the past, produced barrel weights which clamp to the end of the barrel.

However, not everyone found these beneficial. Some people who tried them out found that, while their groups were noticeably tighter, any errors were exaggerated and the rifle was not as forgiving as it was with its normal heavy barrel.

Undoubtedly if you strike a piece of thin steel rod that has been clamped in a vice, you *can* get it to vibrate in a pattern, which indicates a node or stationary point in the vibration (somewhere about three quarters of the way along the rod). However, there is still an overall vibration, i.e. the rod swaying backwards and forwards under the influence of the force from the blow.

In other words, the stationary point appears to be stationary in one set of vibrations, but the rod still has a movement backwards and forwards.

If you attach a weight to the end of the rod, the rod then bows between its two ends. The weight, together with its own inertia, tends to hold the end still as though it was clamped at both ends. That's all pretty obvious, of course, because it doesn't take a moment's thought to realise that the vice at one end is just a very large weight.

The difficulty with all this theory is understanding *how* it relates to your rifle barrel. Unfortunately, there's very much more to this than meets the eye and there will need to be a considerable amount of constructive thinking and experimentation before sufficient work has been done in this area.

'Bench rest' shooters could lead the way in resolving this question, through their quest for accuracy, but their results don't apply directly to .22 prone or 3-P rifle shooters. Bench rest competitors shoot from a much more stable platform and are less likely to be disturbed by any device which may exaggerate an error.

Do be prepared to experiment, but don't fit something on to your rifle and then assume that you've found the answer to all your troubles, just because you have a few good shoots with it. It doesn't work like that.

If you're adding a weight to your muzzle, for example, first shoot with it on, then shoot with it off; keep a note of your scores in as many different conditions as you can, and see if, at the end of the season, you've actually shot better with it on or off.

World record scores have been shot with a standard barrel, and no accessory is going to make the average club shooter into a world champion. The danger lies in assuming that something works because you've had a couple of good shoots.

It's not unusual to find that someone whose shooting has suddenly fallen down around their ears will take everything off their rifle and start again from scratch - it's the fact that they've *changed* something (and have to increase their concentration to adapt to it) which makes them shoot better, not necessarily the change itself.

Barrel vibrations obviously have some effect - whether good or bad is open to question - but a top-class shooter can probably measure an improvement; further down the classes there is more to be gained from getting the technique right than worrying about how your barrel is flexing.

Another thing to bear in mind is that the bullet travelling down the inside of a barrel does have a tendency to smooth out the vibrations as it goes, like water under pressure down a hosepipe. It's possible, therefore, that the wood, the shooter and the bullet itself are all absorbing and dampening vibrations in the barrel.

A 5mm thick piece of steel vibrates madly when struck, but that's because of the relationship between its length and diameter - a piece 30mm long won't vibrate as much as a piece 1000mm long, because the vibrations die away to nothing very quickly indeed. Therefore, the heavier or thicker your barrel is, the less it vibrates.

If you're really interested in stopping barrel vibrations, you could clamp the forend of your barrel (like *BSA* used to do) and that will dampen everything down, but while you reduce the barrel vibrations you may introduce other problems which manufacturers have tried to cure by producing fully-floating barrels.

If you now accept that our barrels do vibrate, as long as that vibration is constant, its effect on the group size may be negligible, but how do you ensure that it *is* constant?

The driving energy which starts the vibration is obviously the powder igniting in the cartridge case. If that were guaranteed to be constant, it would be reasonable to expect the vibration to be constant. The ammunition manufacturers do their best to work to as close a tolerance as they can, but even *they* can't guarantee perfection every time because of the variation in powder, bullet fit, etc.

It's difficult to see how the ammunition manufacturers can make any major improvements in the consistency of their ammunition, apart from manufacturing under laboratory conditions, but then nobody could produce it fast enough to keep up with the rate at which the shooters would use it.

Eley, for example, make approximately 30 batches of *Tenex* a week, at around 25,000 rounds per batch - that's a staggering three quarters of a million rounds of *Tenex* every week, or 39 million a year. They wouldn't make that much if it wasn't being sold.

So we're going to have to accept for a while yet that ammunition is a variable, and, therefore its effect on our barrels is going to vary.

So far we've come to the conclusion that our barrels vibrate and by a different amount with each shot, but how do we minimise the vibration?

Most rifle manufacturers these days fit fully-floating barrels onto their rifles; that means that the barrel is only fixed at one end (usually the breech end), which allows the barrel to float freely when a round is fired.

The manufacturers are unlikely to have chosen that path lightly and you can probably rest assured that, if one manufacturer had devised a system of making his rifles more accurate than anyone else's, all the others would have followed suit very quickly.



Some manufacturers have gone for big heavy square receivers to help dampen movement

However, just to throw a spanner in the works, *BSA* went to a fully-floating barrel when they produced the *Mark III*, but in the *Mark IV* and *Mark V* the forend is fixed to the barrel, not the receiver.

Some manufacturers of early target rifles produced devices fixed to their barrels, which were designed to 'tune' the barrel to a particular batch of ammunition. Like a lot of ideas, that's fine in theory but, in practice, if you get it wrong it tends to make things worse, and there's much more scope for error than there is for hitting just the right spot.

There have been all sorts of experiments carried out in an attempt to alter or stabilise the vibrations of .22 barrels; people have packed a variety of materials between their forend and barrel - anything from foam rubber to bath sealant.

Anything put between the barrel and the forend will certainly have an effect on the vibrations. However, this *could* be a detrimental effect, firstly because the barrel *must* vibrate both up and down, so anything placed under the barrel will reduce or dampen its downward movement while leaving it free to vibrate upwards. That could produce an off-balance vibration, which theoretically doesn't seem right.

Secondly, any substance you put under your barrel creates another variation because various materials change their consistency over a period of time. Foam rubber breaks down and loses its elasticity, bath sealant can go hard and crumble - are you going to hope that what worked initially will still work two years later, or how are you going to decide at what point you need to renew it?

You could, of course, just screw your forend to your barrel like they used to, but that would appear to be flying in the face of the manufacturers' experiences.

Sporting rifles with floating barrels won't shoot straight if the foreend wood is touching the barrel anywhere. Sporting rifles, of course, have much lighter barrels which will vibrate more, and may show a more dramatic effect than the heavyweight target barrels.

One obvious way of reducing barrel vibration is to shorten the barrel. Malcolm Cooper shot a *Walther* with a shortened barrel for some time, and now *Anschutz* have produced a rifle with a very short barrel (the 20...series); the theory is that shortening the barrel but retaining its thickness stiffens it considerably, which will in turn reduce the vibrations.

Lots of people equate length of barrel with accuracy and wrongly assume that a longer barrel is more accurate, simply because they remember John Wayne reaching for his rifle if he had to shoot an Indian more than 10 yards away. However, although rifles *can* be shot more accurately than pistols, that's not because of the actual length of the barrel, but more because of the length of the sight radius and the way the rifle is held.

Therefore, although *Anschutz* have dramatically reduced the length of their latest barrels, they've maintained the sight radius by means of a tube at the end; however, the importance of sight radius is discussed elsewhere.

Provided the barrel is long enough to ensure that all the powder is burned before the bullet exits it, that is sufficient; with the average subsonic rifle round about 375mm is enough; if you add a small safety margin you could say "who needs a barrel longer than 450mm?"

Many of you will probably remember twanging your rulers on the edge of the school desk when the teacher wasn't looking. Do you remember the different sounds that could be made by altering the length and the way you held the ruler? Keep that idea in your head when considering torque settings and bedding.

Those of you who shoot *BSA* rifles won't find this bit particularly interesting but you might be interested if anybody has been able to create a variation in their group size by any experiments with stock tightness. However, whatever you do, *don't* loosen the bolts clamping the barrel into the receiver.

Now, those of you with *Anschutz* rifles may be interested in the results of some very thorough trials carried out by Mr P.J. Andrews of Bedford involving variations in the torque settings of his bedding bolts.



The difference a torque setting can make

There is obviously a relationship between the torque setting and the group size, which is something most of you have realised and tried out for yourselves. For his experiments, the rear bedding screw was set to 5NM and the front one was varied, producing the results shown above.

The groups were shot from the shoulder with a standard *Anschutz 1813*, in as near perfect conditions as can be arranged in this country: you can probably see from the results that the more the front bedding bolt was done up, the more the groups tightened.

It's possible that the groups may continue to shrink if the torque is tightened further but, on the other hand, they may start to open out again. Also, if the back bedding bolt were to be altered, that may produce an entirely different set of results. The only way to prove the case for your particular rifle is to do the experiments yourself and log the results.

Those of you who are habitual ruler twangers will have already made the connection between the change in note of a vibrating ruler and the pressure with which you held it on the edge of your desk. Now you're probably making the same mental connections with the results shown above.

You could be right or you could be wrong. The tightening bedding bolts could be damping down the vibrations; on the other hand they could just be tuning the vibrations to suit that particular batch of ammunition. What is obvious is that the torque setting can have a dramatic effect.

LIST OF EXCUSES.

Shooters love to analyse the results of their shooting, and out of that comes several reasons why they didn't shoot as well as they might. Here's a list of some of those reasons that have been heard around the ranges.

1. My bullet struck a bee on the way down range.
2. I was going well till I got a seven.
3. I was grouping well, just not in the middle.
4. If only I hadn't got all those eights I'd have had a good score.
5. I was scoping the wrong target.
6. I wound the sights the wrong way.
7. I forgot my(fill in any item of equipment).
8. I was grouping in the middle until the wind shifted and then I got an eight at 4 o'clock, so I aimed off and it was an eight the other side, so then I aimed at the middle and it(this story goes on for ever)
9. I had Cornflakes for breakfast.
10. I didn't have any breakfast.
11. I had too much to drink last night.
12. I need a new head/brain.
13. I forgot to set my timer and had to rush the last few shots.
14. I was sure there was something crawling up my trouser leg.
15. I cleaned my rifle last night.
16. I didn't clean my rifle last night.
17. I had a spider spinning a web in my foresight.
18. I lost *all* my squeakers.

19. I had a wind flag in my line of sight.
20. I couldn't see a wind flag.
21. I was going well till the sun came out.
22. My foresight fell off.
23. My target blew away.
24. Somebody cross-shot on my card.
25. I would have scored better if I hadn't shot so badly.
26. I never shoot well on this range.
27. If you leave out all the mistakes I made, I shot quite well really.
28. I started with rubbish, finished with rubbish, and the stuff in between was worse.
29. I was listening to this joke someone was telling behind the firing point.
30. My glasses kept steaming up.
31. I got the hiccups.
32. I sneezed.
33. The bloke next to me had his leg on my mat.
34. I shot absolutely brilliantly and I am well pleased with myself. (This comment is never ever heard on a .22 target rifle range).
35. I would have shot a lot better if I'd read this book first.

GLOSSARY

AIMING OFF

The practice of not aiming at the middle in order to compensate for the wind.

ANY SIGHTS

A competition allowing any form of sights, including optical (i.e. telescopic).

APERTURE

The small hole in the rearsight that you look through to sight the rifle - usually about 1.1mm diameter.

ARMOURY

The strongroom where the rifles are stored.

AVERAGE

Used in its mathematical sense and calculated from your total score divided by the number of shoots.

BACKER

A white card placed behind the target to help you spot your shots and to assist the scorers to sort out *cross shots* or missing shots.

BEDDING

The area where the *receiver* beds down into the *stock*.

BIPOD

A two-legged stand for supporting the rifle while cleaning.

BISLEY

The nearest thing the U.K. has to a national shooting centre; actually a complex of smallbore ranges, fullbore ranges and shotgun ranges, used for most major shooting championships.

BOLT

The part of the rifle action that holds the *firing pin* and *extractors*, inserts the round into the chamber, fires it and extracts it.

BORE

The internal diameter of your rifle.

BRASS

The cartridge cases are made of brass, and it's quicker to say "brass" than "cartridge cases".

BRUSH (PHOSPHOR BRONZE)

A cleaning brush used to scrub out the inside of the barrel. (Made by twisting phosphor bronze wire onto a central core.)

BUBBLE

Refers to a spirit level bubble used to ensure that the rifle is always at the same angle (very often attached to the *foresight*).

BULL

The area within the centre ring of the target that counts for ten points.

BULLET

The grey lump of lead that exits the barrel after the round is fired. It does **not** refer to the whole *round* of ammunition.

BUTT

The rear end of the *stock*.

BUTTS

The target area on the range.

CALIBRE

The internal diameter, or bore, of your rifle.

CANNELURE

The narrow groove around the bullet which is where the case is crimped in, to hold the bullet in the case.

CANT (rhymes with 'pant')

Leaning the rifle over to get the *sights* closer to your eye, or to counteract the effect of the wind.

CARD

A target.

CARTON

The very centre of the *bull*, sometimes shown as a dotted inner circle. (This counts as extra in some competitions.)

CARTRIDGE

A round of ammunition, i.e. brass case, powder, *primer* and lead *bullet*.

CHALLENGES

You are welcome to challenge the score you have been given by a *scorer* at a competition, but there's usually an 'up front' fee which you lose if your challenge is unsuccessful.

CHAMBER

The area at the back of the barrel, slightly larger than the bore and designed to hold the cartridge.

CLICK

Refers to the sound you *sights* make when adjusting them. The noise is caused by a *détente* ball which clicks in and out of grooves in the sight knob. Hence the expression "I had to come over 4 clicks to get into the bull".

CLIPS

Usually bulldog clips for fixing your target to the *target frame*.

COURSE OF FIRE

Refers to the length of a competition and will usually be stated as a certain number of shots at each distance.

CROSS SHOT

When you put a shot on somebody else's target or even on the wrong aiming mark on your own target. There are different scoring penalties depending on the competition. Under *UIT* rules it counts as a 'miss' and therefore knocks ten points off your score, but under *NSRA* rules the penalties are not so severe and you may get away with only one or two penalty points.

CROWN

The area at the extreme end of the *muzzle*. A muzzle is said to be 'crowned' when a chamfer is cut at the very end to protect the end of the *rifling* from damage. Crowning also removes the burr on the inside of the barrel caused by the *rifling* procedure.

DEPTH OF FIELD

The area which is in focus for your eyes. It will vary depending on the size of the *rearsight aperture* of your *sights*.

DETAIL

A particular shooting time controlled by the *Range Officer* when everybody shoots together. Will vary in length, depending on the competition.

DEWAR

A particular *course of fire* of twenty shots at 50 yards (or metres) and twenty shots at 100 yards. A 'Double Dewar' is obviously twice that.

DIOPTER

A lens that can be fitted to a *rearsight* and used to focus at a particular point. Helps old eyes focus on the foresight, and magnifies one and a half times the sight picture. Allowed under *NSRA* rules but not allowed under *UIT* rules.

DISC SHOOT

A fun shoot involving shooting at - and hopefully breaking - white clay discs pinned to a board; usually shot in teams against one another.

DROPPED POINTS

A method of scoring where the score is counted as the number of points that are lost on a target e.g. a 97 would be 3 off and the score entered as 3 rather than 97. It is a natural progression of scoring as you count the shots that miss the bull rather than adding up ten for every bull.

EIGHT

Only a number, but it gains almost mystical significance in the smallbore shooters' minds because they hate them. It basically refers to a shot in the eight ring.

ELEMENT

The plastic or metal ring which fits inside the foresight tunnel and is interchangeable for different sizes.

ELEVATION

The adjustment necessary on the sights to allow for the trajectory of your bullet at different ranges.

EMPTIES

The brass cases you eject all over the firing point during the process of reloading.

ENGLISH MATCH

A particular course of fire involving 60 shots at 50 yards or 50 metres.

ESSU

The English Smallbore Shooting Union.

EXTRACTOR

The spring-loaded claw responsible for pulling your empty cartridge case out of the rifle and throwing it over your next-door neighbour.

FILTER

Some form of coloured glass or plastic fitted to the rearsight to improve the sight picture.

FIRING PIN

A spring-driven pin which hammers into the back of the cartridge case in order to ignite the primer.

FIRING POINT

The area you're given to lay on to shoot your targets. Should be under the control of a *Range Officer*. Ranges are usually measured from the target edge of the firing point (or a line close to it) and the rules state that you should keep the elbow supporting the rifle behind that line.

FLYER

That odd unexplained shot that appears from nowhere and ruins an otherwise good card.

FOREND

That long bit of wood, or more often these days metal, that projects out underneath the barrel. Usually with a slotted rail to take accessories like *handstops*, *sling swivels* and *bipods*.

FORESIGHT

The tube on top of the barrel at the muzzle end of your rifle; this holds the ring elements that form part of the sighting system.

GAUGE

Usually a plug which is inserted into a shot hole which is very close to a line on the target, in order to ascertain whether the shot has broken the line.

GROOVES

Part of the internal rifling of your barrel (see also **LANDS**).

GROUP

One of the most important words in the shooter's dictionary - it refers to a group of shots. The size of the group you shoot is a measure of your proficiency as a shooter. The smaller the group diameter, the more consistent you are. (Usually measured over five or ten shots.)

HANDICAP

A method of scoring to enable novices to compete on equal terms with experts.

HANDSTOP

A fitting attached to the underside of the forend of your rifle to ensure that you always place your hand in the same place every time. May just be a round block, or could be shaped to suit your hand; may also have a *sling swivel* built in.

HANG FIRE

A dangerous situation where the round of ammunition has not ignited immediately it is struck with the firing pin. It's sometimes caused by old ammo or a weak strike by the pin. As a safety precaution you should wait for at least 30 seconds before ejecting the round, if the cartridge fails to ignite at any time.

HEADSPACE

The space between the face of the bolt and the back of the barrel, which holds the rim of the cartridge.

HOOK

The curved tail at the bottom of the butt plate designed to fit under the armpit.

INNER AND OUTER SCORING

Most 25-yard indoor targets are 'outward gauging', i.e. you decide whether the outside edge of the shot hole has broken the line. If so, it's the lower score that counts. Outdoor shooting is usually 'inward gauging', i.e. the innermost edge of the hole is examined to see if it's broken the line. If it has, the higher score is awarded.

IRIS

Usually adjustable and can be fitted to either the foresight or the rearsight. It works by having an interlocking system of leaves that open and close (much like the iris in a camera lens) when you twist the outer ring, yet they remain completely central to the sight line.

ISSF

International Shooting Sports Federation; the governing body for all shooting sports in the UK.

JAG

This is not short for a particular make of car but is the brass tool you fit to the end of a cleaning rod; it has sharp projections to hold the cleaning patch that you wrap around it.

KEYHOLE

There are two possible explanations for this phenomenon. One is the appearance of the hole when a bullet goes through the target sideways, as can happen with poor quality ammunition; the other is when two shots are so close together that they overlap and make a keyhole shape.

KNEELING

One of the three positions of which *prone* and *standing* are the other two.

KNOCKOUTS

Some competitions are arranged on a knockout basis which means basically you keep shooting until you lose, then you're 'knocked out'.

LANDS

The raised parts of the rifling on the inside of your barrel (see also **GROOVES**).

LEAD (rhymes with 'seed')

The part of the chamber which leads into the rifling to give a gradual introduction of the bullet into the rifling. An area which suffers a great deal of wear and tear and may account for why old rifles don't shoot as well as new ones.

LEAD (rhymes with 'bed')

What your bullets are made of.

LEAGUES

In this country competitions are run in leagues, with divisions, promotions and demotions - just the same as in the football leagues.

LUBRICANT

Is what it says, but in shooting it usually refers to the waxy greasy substances sticking to your bullets. It must not be removed before shooting, as it's essential to provide lubrication to your barrel.

MARTINI

Refers to an underlever action normally, found on BSA rifles.

MISFIRE

When the cartridge fails to ignite. The cause should be investigated. It may be a defective round, or a weak strike, or too much headspace, or one of several other possibilities.

MUZZLE

The business end of the barrel where the bullet comes out. Must be kept protected and clean.

NOMINATED MEETINGS

Competitions which have been nominated by the organisers so that competitors may be considered for National Squad selection.

NOMINATED SCORE

Some competitions are organised such that you have to name the score you are going to achieve *before* you shoot; the closest to that score is the winner.

NSRA

The National Smallbore Rifle Association.

OBJECT LENS

The large lens at the target end of your spotting scope or telescopic sight.

OGIVE

The shape of the front of your lead bullets. It takes its name from the shape of church doors.

PAPER SHOTS

Refers to some of the competitions run in the UK which have been sponsored by newspapers.

PATCHES (Cleaning)

Little squares of 'Forbytoo' (4"x2") cloth, cut up ready for you to wrap around a jag.

PATCHES (Target)

Paper patches used to patch the holes in targets so they can be used again without incurring the cost of new targets.

PEEPHOLE

How some people refer to the aperture in your rearsight, because you peep through it.

PIMPERNEL

A target with a central small red dot, which must be totally eliminated by shooting a certain number of shots. Not as easy as it sounds.

POLARISER

A particular filter that can be attached to a rearsight. It works by turning one piece of polarised glass or plastic against another.

POSTAL

Competitions where cards are shot in on a shooter's home range and the cards are posted off to independent scorers. These can be organised nationally or internationally.

PRIMER

The explosive substance that ignites into a very hot flame when struck a blow. It is responsible for igniting the main propellant charge inside your cartridges.

PRONE

One of the three positions, *standing* and *kneeling* being the other two.

QUEEN ALEX (THE)

A competition, for teams and individuals, named after Queen Alexandra, wife of Edward VII. It involves timed rapid shooting as well as the more usual deliberate fire.

RANGE OFFICER

The person responsible for your safety on the firing point and ranges; also responsible for the smooth running of details during competitions.

RANGES

Where all target shooting takes place. Can be indoors at 15, 20 or 25 yards or 25 metres, and outdoors at 50 yards or metres or 100 yards or metres.

REARSIGHT

The large adjustable piece of equipment usually mounted on the receiver of the rifle. Holds the aperture and can be adjusted for *windage* and *elevation* by means of rotating knobs.

RECEIVER

Holds the firing mechanism of the rifle. It can house either a bolt or an underlever. The barrel is fixed into the front end by various methods and the trigger attaches underneath. The whole thing is bolted to the stock either by vertical bedding bolts (in the case of a bolt action) or by a long horizontal stock bolt (in the case of an underlever).

RIFLING

Rifling is made up of a series of lands and grooves down the inside of your barrel. A slow twist in the rifling imparts a spinning motion to the bullet which gives it gyroscopic stability. The bullet has rings on it which engage in the rifling. The average barrel will have seven lands and seven grooves and will twist approximately one and a quarter times down the length of the barrel.

RIMFIRE

All .22 ammunition currently used in smallbore competitions is rimfire ammunition. The case has an enlarged diameter at the back, which forms a rim into which an explosive compound is put during manufacture. When the trigger is released the firing pin strikes the rim and crushes it, which explodes the primer inside. That in turn ignites the main propellant powder.

ROBERTS (THE)

The British Long-Range Championships are held every year at Bisley and that competition is referred to as 'The Roberts' after Earl Roberts.

ROUND

Each competition in the league and knockout events is referred to as a 'round'.

ROUNDS

As in 'rounds' of ammunition and refers to the complete cartridge.

SCORER

Those poor volunteers who dedicate their lives to working out your scores for you, either in the postal leagues or at shoulder-to-shoulder competitions.

SCOTTISH (THE)

A national meeting held at a different venue in Scotland each year; open to all nationalities, although the 'Earl Haig' is restricted to Scottish nationals.

SCOTTISH MATCH

Sixty shots at 100 yards.

SHOULDER-TO-SHOULDER

A competition where everybody shoots together on the same range. The expression comes from the fact that shooters lay 'shoulder to shoulder' when shooting prone.

SIGHTER

The target you're given with your match cards; this is non-scoring, to allow you to sight in the rifle before shooting the shots that count.

SINGLE STAGE

Refers to a trigger having only one movement to release it.

SLING

Can be one-piece (most likely), or two-piece, and is used to support the rifle while shooting.

SLING SWIVEL

The attachment on the rifle that allows you to connect the sling to the rifle.

SSSU

Scottish Smallbore Shooting Union

STANDING

The most difficult of all the positions.

STATS

Short for 'statistical office'; will be found at all shoulder-to-shoulder competitions. It's where the scoring is done, away from the prying eyes of the shooters. Scores are usually displayed outside 'stats' for all to see.

STICKERS

The self-adhesive labels issued by competition organisers, to be stuck to your targets before they're shot. The sticker often has to be placed where a shot will pass through it, to stop anybody putting the sticker on a good card after it's shot. (Not that anybody would, as cheating is almost unheard of in the sport!)

STOCK

The big brown wooden bit (or it might be multi coloured or metal or both, these days) that you hold to shoot your rifle.

TARGET CHANGERS

Overseas ranges very often have a system where the target travels backwards and forwards down the range at the push of a button, or where the targets are all folded up inside a box and the push of a button releases the next target. Only a few ranges in the UK have this facility.

TARGET FRAMES

Usually wood but may be plastic; used to hold the target in place at the butts. Targets are attached with clips, elastic or sundry other methods.

THUMBHOLE

Some stocks have a hole through them to accommodate the thumb in a more natural position when shooting.

TON

A ton is a score of 100.

TORQUE SETTING

The bedding bolts that clamp the stock to the receiver can be 'torqued up' to different settings to alter the barrel vibrations.

TRAJECTORY

As soon as your bullet leaves the muzzle it is affected by gravity and, as it slows down because of air resistance, that effect increases. Hence your bullet follows a downward curved path which gets steeper as the bullet slows. This is called the trajectory and is why you have to increase the elevation of the rearsight as you move to longer ranges.

TRIGGER

The trigger is responsible for holding back the firing pin and then releasing it when you're ready. It refers to the whole mechanism not just the trigger blade, which is the bit you put your finger on.

TWO STAGE

A trigger that has a small amount of lighter movement before it reaches the release point.

UIT (UNION INTERNATIONALE DE TIR)

Literally translated, the International Shooting Union; the body which lays down the rules for most European competitions.

UNDERLEVER

A mechanism for cocking and unloading a rifle mostly found on *BSA* rifles.

WAILING WALL

Popular name for the place where the scores are displayed.

WIND FLAG

Refers (fairly obviously) to a small flag placed out on the range to help you make some sort of attempt at deciphering what the wind is doing. There's nothing to stop you making and using your own, but they won't be allowed in shoulder-to-shoulder competitions.

WINDAGE

As with *elevation*, it's an adjustment you make to your sight to make allowance for the bullet drift caused by the wind.

WITNESS

Means the same as in law; refers to you having to get your targets signed by an official witness to say that they were shot in accordance with the appropriate rules of the competition.

WOOL MOP

An attachment for a cleaning rod made from sheep's wool; used for depositing oil down the inside of your barrel for protection, should you have to leave it unused for any length of time.

WSSU

Welsh Smallbore Shooting Union.

X CLASS

Formerly described the top one hundred shooters in the UK and entry was by invitation only. Now it simply refers to the highest classification, and shooters are promoted and demoted on their performance, usually at the National meetings.

X-RING

The innermost ring of a target. Another name for the 'carton' mentioned earlier.

ZEROING

Adjusting your sights so the shots fall in the centre of the target.

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